Final Report

Independent Cost Review of the Arrowhead-Weston Project

#RPA-PSD-160

Public Service Commission of Wisconsin
Electric Division

July 2003

July 7, 2003

Scot Cullen, Chief Engineer
Electric Division
Public Service Commission of Wisconsin
610 North Whitney Way
P.O. Box 7854
Madison, WI 53707

Subject: **R. W. Beck Report**
Arrowhead–Weston Cost Estimate Review

Dear Mr. Cullen:

The attached report is the result of our review of routes and estimates for the Arrowhead–Weston Transmission Project and the alternate King–Weston route. The report represents our opinions based on a review of information and data provided and an on-site fly over of the subject routes.

We trust this report meets your needs and we stand ready to provide further support.

Sincerely,
R. W. BECK, INC.

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Project Manager

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PUBLIC SERVICE COMMISION OF WISCONSIN
INDEPENDENT COST REVIEW
ARROWHEAD-WESTON PROJECT
FINAL REPORT

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EXECUTIVE SUMMARY

Project Purpose and System Description

R. W. Beck, Inc. (the "Independent Engineer" or "Beck") was retained by The Public Service Commission of Wisconsin ("Commission") to assess the reasonableness of the revised cost estimate of the Arrowhead–Weston transmission line project and to review cost estimates for the King–Weston alternative, proposed by Wisconsin Public Service Corporation, Minnesota Power and American Transmission Company ("Applicants").

Methodology

An evaluation was conducted with focus on the following:

- Physical inspection of the Arrowhead–Weston route and the King–Weston alternative route
- Review of the Arrowhead–Weston line cost estimate filed by the Applicants as well as an assessment of the justification for those costs
- Review an independent analysis of the proposed contingency levels
- Review of the King–Weston line alternative based upon estimating methods used for the Arrowhead–Weston estimate, recognizing that this alternative has not been fully engineered
- Review of estimated costs and independent analysis of the King–Weston route includes;
  - Route location
  - Basis of cost differences between the routes
  - Cost drivers in year-of-occurrence dollars
  - Review of preferred pole structure equipment
  - Estimated time to in-service date
- Analysis of potential cost impacts from environmental factors
- Expert testimony before the Commission regarding the independent cost analysis and estimates

This report addresses these areas as they relate to the review of cost estimates and includes the results of our investigations. Each section of the report contains an overview of general observations and a summary of findings and recommendations.

Additional detail from field observations of transmission, substation, and distribution facilities may be found in the appendices of the report.

Beck visited and performed general field observations of the transmission, and substation facilities. The field observations were visual, above-ground and general observations of selected areas which we deemed adequate to be able to comment on the review of the cost estimates of the Arrowhead–Weston and King–Weston lines.

Summary and Findings

Based on our field observations of transmission and substation facilities, interviews with key staff, and review of engineering and operations needs, our principal opinions regarding the cost estimates for the Arrowhead–Weston transmission line and the King–Weston alternative transmission line are as follows:

Arrowhead–Weston

Two key issues that could affect the above costs include farm disease mitigation cost and licensing cost. Farm disease mitigation is a new issue that was recently identified during the review of the Arrowhead–Weston Project. The Applicants and PEI have investigated this issue and consulted with agricultural officials to define the required mitigation and associated costs. Based on these investigations a lump sum estimate of $15,000,000 has been allocated for farm disease mitigation, which is considered reasonable at this time. However, due to the magnitude of costs involved and the uncertainty, further investigation is warranted.

The Applicants have provided incurred licensing costs for the approved route for the period of January 1, 2001 through the spring of 2003 at $8,239,000. All federal, state and local permits and approvals remain to be secured. ATC has indicated that the costs to secure these permit approvals may be approximately $20,000,000 and that such costs are included in the local and foreign engineering costs. The local and foreign engineering costs are currently estimated at $16,571,841 and $16,096,620, respectively. As stated above in the discussion of these cost components, these engineering costs appear to be reasonable for the typical costs associated with owner's engineering costs and design engineering costs. However, if $20,000,000 or more is required for securing the Project permits and approvals, the overall estimate for Local and Foreign Engineering may be low.

The following table details the total costs for transmission line construction evaluated for in the report with contingency. The totals evaluated without contingency result in a decrease of less than 3%. For a project of this size and scope and the assumptions that were made, the Power Engineers, Inc. cost estimate and the Black & Veatch cost estimate review for the Arrowhead-Weston line route appears reasonable.

Table ES-1
Arrowhead-Weston Transmission Line Construction Cost Summary Comparison

PROJECT ELEMENT DESCRIPTIONS	PEI VALUES	R. W. BECK VALUES
TRANSMISSION CONSTRUCTION		
Structures & Foundations	$120,718,403	$119,518,403
Foundation Adders	$6,655,603	$6,655,603
Counterpoise for Added Grounding	$953,379	$953,379
Wire	$30,825,867	$30,825,867
Wetlands Accessibility Adder	$8,819,326	$8,819,326
Mobilization and Demobilization	$1,140,440	$1,140,440
Environmental Devices	$1,890,577	$1,890,577
Miscellaneous Construction Items	$1,630,237	$1,630,237
Contractor Field Office Facilities and Personnel	$4,066,908	$4,066,908
Construction & Mitigation Plan – Premium & Monitoring	$6,060,000	$6,060,000
Construction Management	$9,226,380	$9,226,380
TOTAL TRANSMISSION CONSTRUCTION	**$191,987,120**	**$191,987,120**
COMMUNICATION - OPGW 12-fiber	**$4,312,000**	**$4,312,000**
CLEARING RIGHT-OF-WAY	**$7,221,722**	**$8,546,723**
LAND RIGHTS - EASEMENTS		
ROW Acquisition & Legal Assistance	$23,942,500	$16,087,908
Railroad & Pipeline Interference Studies	$1,225,000	$1,225,000
Namekagon EIS	$500,000	$500,000
TOTAL LAND RIGHTS - EASEMENTS	**$25,667,500**	**$17,812,908**
REMOVAL	**$2,702,778**	**$2,702,778**
SALVAGE	**$(58,900)**	**$0**
LOCAL ENGINEERING	**$16,571,841**	**$16,571,841**
FOREIGN ENGINEERING	**$16,096,620**	**$16,096,620**
FARM DISEASE MITIGATION	**$15,000,000**	**$15,000,000**
TEMPORARY LINE CONSTRUCTION	**$2,000,000**	**$2,000,000**
SUBTOTAL TRANSMISSION LINE CONSTRUCTION	**$281,500,681**	**$273,427,111**
CONTINGENCY – 15%	**$0**[1]	**$41,014,066**
TOTAL TRANSMISSION LINE CONSTRUCTION	**$281,500,681**	**$314,441,178**

[1] No contingency was specified except in the values for Land Rights and Substations.

Below is a total project cost comparison without contingency.

Table ES-2
Arrowhead-Weston Cost Summary Comparison Without Contingency

Description	PEI Cost Estimate	R. W. Beck Values
Transmission Line	$281,500,681	$273,427,111[1]
Substations	$56,804,501	$56,804,501
Subtotal Transmission Line & Substations	$338,305,184	$330,231,612
Licensing	$8,239,000	$8,239,000
Environmental Impact Fee	$17,360,966	$17,020,352
AFUDC	$56,402,332[2]	$55,250,718[3]
Totals	**$420,307,482**	**$410,741,682**

King–Weston Transmission Line Alternative

The following table details the total costs for transmission line construction evaluated for in the report. The totals evaluated without contingency result in an increase of less than 3%. For a project of this size and scope and the assumptions that were made, the Black and Veatch cost estimate for the alternative King–Weston line route appears reasonable.

[1] In order to compare values on a relative basis, contingency has been excluded. However, given the uncertainty with respect to licensing costs, farm disease mitigation and land rights-easements consideration should be given to include a contingency in the total project cost.
[2] $57,912,394 After correcting for apparent interest rate error (15.9% - Transmission line subtotal plus environmental impact fee.
[3] 15.9% of transmission line subtotal plus environmental impact fee.

Table ES-3
King-Weston Transmission Line Construction Cost Summary Comparison

PROJECT ELEMENT DESCRIPTIONS	B&V VALUES	R. W. BECK VALUES
TRANSMISSION CONSTRUCTION		
Structures & Foundations	$74,431,560	$77,500,020
Foundation Adders	$5,002,090	$5,031,172
Counterpoise for Added Grounding	$721,811	$721,811
Wire	$23,997,911	$23,633,874
Wetlands Accessibility Adder	$3,641,247	$2,231,311
Mobilization and Demobilization	$1,140,440	$863,360
Environmental Devices	$1,382,825	$1,431,240
Miscellaneous Construction Items	$853,906	$1,234,153
Contractor Field Office Facilities and Personnel	$2,991,848	$3,078,807
Construction & Mitigation Plan – Premium & Monitoring	$4,591,827	$4,587,657
Construction Management	$6,991,080	$6,984,730
TOTAL TRANSMISSION CONSTRUCTION	**$125,746,545**	**$127,298,135**
COMMUNICATION - OPGW 12-fiber	**$1,833,700**	**$3,267,320**
CLEARING RIGHT-OF-WAY	**$5,122,286**	**$6,033,853**
LAND RIGHTS - EASEMENTS	**$18,936,000**	**$18,936,000**
REMOVAL	**$2,031,075**	**$2,031,075**
SALVAGE	**$(92,880)**	**$(92,880)**
LOCAL ENGINEERING	**$11,362,077**	**$11,362,077**
FOREIGN ENGINEERING	**$12,185,770**	**$12,185,770**
MISCELLANEOUS TRANSMISSION LINE		
Farm Disease Mitigation	$25,648,747	$27,573,590
Outage Management	$4,180,773	$4,180,773
Temporary Line Construction	$2,000,000	$2,000,000
TOTAL MISCELLANEOUS TRANSMISSION LINE	**$31,829,520**	**$33,754,363**
SUBTOTAL TRANSMISSION LINE CONSTRUCTION	**$208,954,093**	**$214,775,713**
CONTINGENCY – 25%	**$0**[1]	**$53,693,928**
TOTAL TRANSMISSION LINE CONSTRUCTION	**$208,954,093**	**$268,469,641**

Below is the total project cost comparison without contingency. The transmission line and substations have been inflated over 5 years at 3% per year due to the additional time required for permitting, licensing, environmental impact statements, public review and comment, and Commission review. The approximate inflation value for the 5 year extension for the transmission line and substations totaled 15.93%. If the $208,954,093 for the total line construction is inflated at an approximate rate of 3%

[1] No contingency was specified except in the values for Land Rights and Substations.

over the estimated period of 5 years the result is $241,987,137. The R.W. Beck value of $214,775,713 for total line construction without contingency will inflate to $248,983,916.

The AFUDC calculations were based upon the Applicants spreadsheets which made assumptions for cash flow and the extended project schedule. B&V calculated the AFUDC differently than the Applicants which resulted in a difference. This evaluation involved using the same methods as supplied to PEI by the Applicants for the Arrowhead–Weston line.

Table ES-4
King–Weston Total Project Cost Summary Comparison Without Contingency

Description	B&V Cost Estimate	R. W. BECK VALUES
Transmission Line	$241,987,137	$248,983,916[1]
Substations	$45,009,975	$45,009,975
Subtotal Transmission Line & Substations	$286,997,112	$293,993,891
Costs Expended to Date	$17,700,000	$17,700,000
Licensing	$14,100,000	$14,100,000
Environmental Impact Fee	$16,397,720	$16,331,288
AFUDC	$51,512,838[2]	$42,267,510[3,4]
Total Project Cost	**$386,707,670**	**$384,392,689**

The project estimates were developed from many sources and various assumptions that may vary the final cost after all the project parameters are established. The high level of detail involved along with the numerous revisions in the cost estimate preparation for the Arrowhead–Weston project may result in the final updated costs for the King–Weston project to vary significantly.

The alternative estimate was based on existing transmission lines, within share rights-of-way, being de-energized during the construction period. No additional costs are included for river crossings or underground crossings at the river locations. Additional costs of overhead river crossings could be several million dollars and the underground crossing at the Interstate 94 bridge over the St. Croix River may be in the 10 million dollar range, as a minimum.

[1] In order to compare values on a relative basis, contingency has been excluded. However, given the uncertainty with respect to licensing costs, farm disease mitigation and land rights-easements consideration should be given to include a contingency in the total project cost.
[2] $43,544,835 at a debt cost of 3.5% or 14.35% of transmission line subtotal plus environmental impact fee.
[3] 16.98% of transmission line subtotal plus environmental impact fee.
[4] $44,094,423 after adjusting AFUDC to debt costs of 3.5% (16.98% - Transmission line subtotal plus environmental impact fee.

Section 1
INTRODUCTION

1.1 Project Purpose

R. W. Beck, Inc. (the "Independent Engineer" or "Beck") was retained by The Public Service Commission of Wisconsin ("Commission") to assess the reasonableness of the revised cost estimate of the Arrowhead–Weston transmission line and to review cost estimates for the King–Weston alternative proposed by Wisconsin Public Service Corporation, Minnesota Power and American Transmission Company ("Applicants").

1.2 Methodology

The following identifies the proposed methodology used to review the reasonableness of the cost estimates for installing the Arrowhead–Weston and the alternate King–Weston transmission facilities:

1. Commission Docket 05-CE-113 documents were compiled, organized, and cataloged in a master list of documents received and each one was given a document control number for purposes of a common reference designation by team members. A master file of the original documents is in the Beck Nashville office and is available for disbursement. The documents were distributed to the team members based upon their areas of expertise and project responsibilities. Team members reviewed the project history and evolution of the cost estimates.

2. Team members reviewed the cost estimates for quantity errors and omissions and for needed additional documentation support requests. Team members determined if any element of the transmission project estimate appeared to be missing, redundant or unnecessary. Basic calculations, (i.e. line lengths), were performed to ensure that quantities are consistent with projects of similar type and size.

3. The construction cost estimate breakdowns and the major cost components were reviewed on a unit cost basis to determine if both assumptions and unit prices were reasonable. To the extent practical, a comparison was performed of the major cost items (i.e. structures, foundations, conductor, insulators and hardware) to the total cost of material and labor and also compared to historical cost data of similar projects. Labor and material ratios were evaluated for reasonableness considering the particular circumstances and assumptions of each alignment.

4. The Construction and Mitigation Plan Implementation requirements and mitigation methodology were reviewed to determine what restrictions were

imposed on the construction process, their appropriateness and their impact on the estimated construction costs along with the requirements for compliance monitoring.

5. A review of miscellaneous cost components such as local and foreign engineering, construction monitoring, construction management, land purchase, clearing, acquisition, AFUDC, licensing, legal, and special studies (i.e. pipeline & RR interference, Namekagon River, EIS) were reviewed for reasonableness, consistency, and cost impacts.

1.3 Report Description

1.3.1 Arrowhead–Weston Route

The route for the Arrowhead–Weston 345 kV transmission line is illustrated in Figure 2-1 in the Construction and Mitigation Plan, Part A document and shows the portions of line that utilize corridor sharing. Detailed route maps are provided in Appendix A of that same document for the portion of line in Wisconsin. These figures identify the route by line segments and show the associated substation facilities and the rivers and streams that will be crossed.

The portion of the line in Minnesota is about 12-miles long. The route follows existing transmission line corridors southeast from the Arrowhead Substation, near the intersection of Morris Thomas and Midway roads in Duluth, to the St. Louis River, just north of the Highway 39/105 Bridge.

The portion of the line in Wisconsin is 208 miles long. The route runs east for about 9 miles from the St. Louis River along the Duluth, Missabe, and Iron Range Railway Company (DM&IR) railroad to Lyman Lake Road, about 8 miles east of Oliver. It runs generally southeast for about 143 miles to the Owen-Withee area, passing just west of Solon Springs, east of Stone Lake, west of Ladysmith, west of Sheldon, and west of Gilman. In this 143 miles, much of the route follows existing electric transmission corridors owned by Superior Water, Light, and Power (SWL&P), Dairyland Power Company (DPC), and Xcel Energy (formerly Northern States Power), an existing Enbridge Energy (Lakehead Pipeline) corridor and existing Wisconsin Central Railroad corridor. The route then turns and runs generally east for about 56 miles, passing just south of Abbotsford and Edgar until it reaches Weston Substation, which is located about 7 miles south of Wausau. About 35 miles of this 56-mile length follows existing transmission line corridors owned by ATC and Xcel Energy.

1.3.2 King–Weston Route

The alignment of this Alternative is shown on drawings titled, Option 10(1)-1, Option 10(1)-2, and Option 10(1)-3. The Option 10(1) alignment is along the south corridor associated with this route. It utilizes the approved route for the Arrowhead–Weston Project from a point west of Withee, Wisconsin to Weston Substation.

The total length of this Alternative is 166.7 miles. The total length consists of 20.2 miles cross-country, 73.4 miles paralleling highways, 8.6 miles paralleling existing 345 kV transmission lines, 5.1 miles paralleling an existing 161 kV transmission line and 59.4 miles paralleling an existing 115 kV transmission line.

This Alternative originates at the King Substation that is north of Bayport, Minnesota. It proceeds in a southerly direction, paralleling Highway 95, for a distance of 4.7 miles where it intersects Interstate Highway 94. It turns to the east, crosses the St. Croix River into Wisconsin and parallels Highway I-94 for 61.6 miles where it intersects a 345 kV transmission line from the Eau Claire Substation. The route then proceeds east, paralleling the existing 345 kV line for a distance of 4.2 miles, where it enters the Eau Claire Substation.

The route leaves the Eau Claire Substation heading east and paralleling an existing 345 kV circuit for a distance of 1.2 miles. The route then bears in a northerly direction and parallels Highway 124 for 7.1 miles where it intersects an existing 161 kV transmission line, then in an easterly direction, paralleling the 161 kV line for 5.1 miles, until it reaches a substation east southeast of Chippewa Falls, Wisconsin. From this substation, the route proceeds in an easterly direction for 26.6 miles, paralleling an existing 115 kV transmission line, where it intersects the approved route for the Arrowhead–Weston Project. It continues east, still paralleling the 115 kV line and on the approved route for a distance of 32.8 miles. The section of the route that parallels the existing 161 kV and 115 kV lines also generally parallels Highway 29.

At this point, north of Fenwood, Wisconsin, the route takes a southeasterly heading, cross-country for a distance of 12.7 miles. It then continues, cross-country, in an easterly direction for a distance of 7.5 miles where the route intersects an existing 345 kV transmission line. It parallels the 345 kV line going northeast for 1.2 miles and then east for 2.0 miles where it enters the Weston Substation.

Section 2
ARROWHEAD–WESTON ROUTE

In the following Section, the total line construction cost of $208,987,118 used for the evaluation includes labor and materials for the transmission line, farm disease mitigation, and temporary line construction. The total project cost of $420,307,482 used for the evaluation includes project licensing, transmission line, clearing, land rights – easements, removal, salvage, substations local and foreign engineering, environmental impact fee, and AFUDC. Both of these values were taken from the May 6, 2003 PEI cost estimate.

2.1 Structures

Structure material costs depend largely on structure weight and are also affected by design complexity, schedule constraints, design loading criteria, and size of the manufacturing order. Labor and equipment to install structures depends largely on structure weight and height but is also impacted by access conditions.

2.1.1 PEI Values and Methodology

Power Engineers, Inc. (PEI) selected [or was directed to use] a family of single shaft, self-supporting, self-weathering, steel poles for all line applications. In their cost estimate PEI included, in the unit structure costs, insulator assemblies, conductor attachments, vibration control devices, grounding, signs, foundations, and other components that could be allocated to a discrete structure.

PEI and the Applicants worked with Thomas & Betts, a major steel pole manufacturer, to develop structure designs and unit costs.

The structure family includes both single and double circuit configurations. The non-dead-end structures (angle classes) include tangents (85% of total), small angle, medium angle, and large angle types. Dead-end structures include PEI's designated Type 2 and Type 4 towers.

For the Wisconsin portion of the project, the cost estimate includes 1501 structures of which 822 are single-circuit, 345 kV structures (all types). The remaining structures are for double circuit applications where the project is planning to combine existing and new circuits with the main 345 kV circuit.

Structure shaft weights for single circuit, non dead-end structures range from 17.9 kips (1 kip=1000 lbs.) to 46.8kips, while dead-end structure shaft weights range from 93kips to 119kips. Single circuit structure heights range 110–145 feet.

Structure shaft weights for double circuit, non dead-end structures range from 29.3kips to 76.9kips, while dead-end structure shaft weights range from 127.4kips to 246.2kips. Double circuit structure heights range 130–170 feet.

With the structure family selected it is relatively easy to apply the appropriate structure (considering line angle and height) based on its location in the alignment. PEI appears to have developed a typical structure family and cost estimate to allow the use of optimization software.

PEI applied a $1.00 per lb, cost of steel. This cost was cited as valid through 2008, according to Thomas & Betts.

The PEI labor/material/equipment ("LME") cost to install structures ranges from 6% to 18% of structure material costs.

2.1.2 Review Methodology and Comparisons

Steel costs were extracted from the PEI estimate dated May 6, 2003, separating steel costs from insulator, foundation and miscellaneous costs.

The structure heights were reviewed and evaluated based on preliminary sag and tension calculations, average and typical span lengths, and standard project design criteria. Beck consulted the EPRI Red Book for similar 345 kV line information for the northern states. They appear reasonable for the structure type, span range, and 345 kV circuit voltage. Design criteria sketches were inspected for design information such as phase separation and ground clearance to support our review.

Based on our experience, the range of structure weights are reasonable for the type, design loading conditions, and heights. Thomas & Betts information provides further confidence in these weights.

Review of the cost of steel was based on our knowledge of the industry and known historic ranges of steel pole prices (steel pole prices have ranged from $0.75 per lb to about $1.20 per lb). So, estimating prices of $1.00 per lb are commonly used in planning estimates.

The low end of the cost range would apply to larger orders, simple designs, soft market conditions, and a practical schedule. The high end of the cost range represents smaller orders, complex designs, high demand market conditions and aggressive schedules. The magnitude of this project will attract very competitive steel prices. Recently manufacturers have offered $0.75 to $0.90 for galvanized structures. This project is using self-weathering steel, so the cost of galvanizing is eliminated. Costs could be even less.

Unit costs for structure LME are based on percent of total installed costs. They are typically under 20% of structure material costs. PEI kept the same LME unit price for similar types and heights of structures, regardless of weight.

2.1.3 Summary and Findings

The family of self-supporting, single steel pole structures appears to be appropriate for this application (extensive, intermittent double circuiting).

The structures represent 38% ($79.2 million) of the total construction costs, excluding engineering and land costs. This is slightly higher than our project experience, but appears to be reasonable considering the complexity of the structure family, heavy loading criteria, extensive double circuiting, and use of double bundling.

The LME to install the structures is less than 20% of total structure installed cost and appears reasonable.

The unit price of steel, $1.00 per lb, while a common figure, is higher than normal expected for such a large order, unless special plate thickness is required or the shear number of structure variations renders this a complex order. If the price of steel was to drop below $0.90 per lb, and that does not appear likely, this would decrease the overall cost by only $1.2 million for the material. Probably not worth considering.

2.2 Foundations and Foundation Adders

Foundation costs include the costs of excavation, hauling and spreading of excavated material. It includes hole stabilization, reinforcing steel fabrication, reinforcing steel setting, anchor bolt assembly setting, concrete placement, and special curing methods for hot or cold weather.

2.2.1 PEI Values and Methodology

PEI selected a drilled pier, steel reinforced foundation for the support of all structure types. The cost of the foundations was added to structure unit costs. In some cases PEI determined a melded foundation cost for a structure based on percentages of two different length foundations of the same diameter. This reflects uncertainty in the soil conditions at each site and the expectation that some of each type foundation will likely be required. A prudent thing to do.

The family of foundations is closely related to the structure weight. Foundations range in diameter from 6 to 14 feet, and are from 20 to 50 feet deep (plus a one-foot reveal). The volume of concrete for these foundations ranges from about 27 cubic yards (“cy”) to 285 cy.

PEI based design and sizing of the foundations on geotechnical reports by Tri-State Drilling and Twin Ports Testing, as well as project design criteria. Approximately 281 borings were taken for the 220.2-mile line.

PEI costs for the foundations worked out to $402 per cy to $556 per cy. PEI obtained LME bid quotations costs for the foundations from a major line contractor, MJ Electric, Inc. (MJE), which validates the unit costs.

In addition, PEI included allowances for rock excavation, hole stabilization and wetland accessibility, amounting to $14.4 million. These are allocated as extra

foundation costs. This amounts to another $262 per cy above the base cost of foundations.

2.2.2 Review Methodology and Comparisons

Soil boring records and foundation assumptions were reviewed briefly in the cost estimate prepared by PEI. The reinforced concrete volumes for foundations were checked from dimensions assumed in the cost estimate detail.

Development of costs for the foundations was performed by building up a cost, based on RS Means Heavy Construction 2003 figures using unit costs for reinforcing steel, excavation, and concrete placement. A concrete supplier in Ladysmith, WI was contacted and concurred with unit costs for winter additives to concrete reported by RS Means ($75 per cy to $85 per cy depending upon the extent of winter deliveries). The unit installed costs are $280 per cy to $426 per cy and did not include costs for hauling or spreading excavated materials, hole stabilization, equipment mobilization and demobilization among the sites and other miscellaneous factors that could increase the cost of foundations. Concrete delivery may also be problematic over the entire length of line, requiring several suppliers or placement of strategic batch plants to serve this project.

2.2.3 Summary and Findings

The foundation type selected by PEI is consistent with the type of structure selected and is common in the industry for similar applications.

The foundations represent 21% ($43.3 million) of total construction costs. This is reasonable, considering previous experience and appears consistent with the type and size of structures assumed.

The foundation sizes are as expected based on experience with similar projects and is supported by soil borings approximately every mile for the Wisconsin and Minnesota portions of the line. The extensive soil investigation program provides a solid design basis for analysis.

The PEI unit cost for foundations of $400 per cy to $550 per cy plus the $109 per cy allowance for unstable holes and rock, seems reasonable. From past project experience, unit costs for similar drilled pier foundations are in the range of $300 per cy to $350 per cy. These prices are based on mostly urban situations where concrete delivery routes are shorter, concrete is more readily available in quantities required, and where site access is confined. The extra costs related to access to the sites, mobilization and demobilization among sites, delivery distance from batch plants, and the need for cold/hot treatment of concrete would justify an increase in the unit price.

2.3 Counterpoise Wire for Added Grounding

This unit includes furnishing and installing added ground wire to achieve project design targets for ground resistance.

2.3.1 PEI Values and Methodology

PEI assumed 1000 feet of additional counterpoise per mile of line. This is based on soil resistivity readings taken in conjunction with the soils investigations and input from the Applicants' experience.

PEI assumed $0.55 per ft. for copper counterpoise wire and $3.78 per ft. for installation. These costs were not verified with MJE nor other local suppliers.

2.3.2 Review Methodology and Comparisons

Typically counterpoise would be plowed in with specialized plow/cable laying equipment. Difficult right-of-way conditions may make this kind of installation troublesome, therefore more expensive.

Our grounding cost estimates obtained from RS Means were used to compute the material/LME cost ratio.

2.3.3 Summary and Findings

The counterpoise represents 0.5% ($0.9 million) of total construction cost. This is a very minor cost component, with little impact on the total.

The addition of 1000 feet of counterpoise per mile of line leads to about 220,200 feet of counterpoise. PEI assumed the cost of bare copper wire at $0.55 per ft. The bare 2003 material cost for 4/0 copper wire from RS Means is about $1.50 per ft. The size of wire assumed for counterpoise is unknown, but 4/0 is typical in previous project experience. The $0.55 per ft. cost may represent a smaller wire with significant price discount for quantity. The RS Means estimated cost for installation of 4/0 ground wire is about $1.00 per ft. as compared to PEI estimate of $3.78 per foot. This results in the RS Means value being 40% of total costs compared to the PEI estimate where installation is 87% of total costs. If the RS Means values are used, the cost for counterpoise wire is approximately $2.50 per foot, for a total cost of $550,500. This results in a decrease of $402,966.

Alternative grounding enhancements could be employed or efficient mechanized installation methods used to drop the installation cost assumed in the PEI cost estimate. Any improvements in this cost will have a minor impact on the overall construction costs.

2.4 Wire

The category description of wire in this report refers to the total labor and material for a complete installation of conductor and shield wire. The cost of wire includes the price of conductor, stringing the conductor on the structures, sagging (tensioning the conductor to a pre-determined sag), clipping (attaching the conductor to the insulators on the structures), and splicing (connecting two pieces of conductor together). It also includes installation of spacers in mid-span.

2.4.1 PEI Values and Methodology

PEI selected 1272 kcmil ACSR, Bittern, and 954 kcmil ACSR, Rail, for the primary transmission conductors. Some 795 kcmil ACSR, Drake, was also used in limited amounts.

PEI obtained conductor costs from local suppliers.

PEI assumed material costs of $1.44 per ft. for 954 kcmil–Rail conductor, $1.68 per ft. for 1272 kcmil–Bittern conductor, and $1.21 per ft. for 795 kcmil–Drake conductor.

PEI assumed an installation cost of $10,938 per wire-mile irrespective of wire size.

2.4.2 Review Methodology and Comparisons

The quantities appear to be reasonable based on the assumptions and circuit requirements.

For comparison, list prices for standard ACSR conductor were obtained from Southwire's web site. The unit material costs used by PEI ($1.21 per ft. for Drake, $1.44 per ft. for Rail, and $1.68 per ft. for Bittern) are lower than the list prices ($1.41 per ft. for Drake, $1.54 per ft. for Rail, and $2.00 per ft. for Bittern). This represents typical quantity discounts offered by manufacturers.

Installation costs were reviewed for wire, based on previous project experience. Using a stringing crew of 12, working for 12 hours per day, installing one wire-mile, at $75 per hr loaded labor rate is $10,800 per mile. This includes pulling equipment setup, hanging sheaves, pulling pilot line, pulling wire, sagging and clipping, mobilization and demobilization at approximately eight structures, and installation of spacers on conductor bundles. This compares well with our general experience of allowing for stringing one circuit-mile of line in one week, in hilly terrain. Stringing three wires is about a week's work consistent with PEI's estimate.

2.4.3 Summary and Findings

Conductors represent about 14% ($28.8 million) of total construction costs, excluding engineering and land costs. The labor/material components are 59% labor and equipment and 41% material. These figures are reasonable for this type of construction and in-line with our expectations.

2.5 Wetlands Accessibility Adder

Wetland accessibility adders include: 1) installation and removal of access roads outside the ROW, and 2) procurement, installation and removal of temporary hardwood timber mats in wetland areas where construction equipment must access pole locations while minimizing soil disturbance.

2.5.1 PEI Values and Methodology

PEI's latest estimate is based on estimates provided by MJE and assumed the installation of 185, 4ft. x 18 ft. hardwood mats for each structure in wetlands. A limited number of 4 ft. x 30 ft. mats was included for difficult construction areas. Total structures to be installed in wetlands were estimated to be 239 with 101 wetland structures in the Weston–Bass Lake segment, 123 wetland structures in the Bass Lake–St. Louis River segment and 15 structures in the St. Louis River–Arrowhead segment. These numbers were based on wetland map reviews and preliminary pole spotting analysis. Hardwood mats were assumed to be $492 each with transportation to the project site at $2.69 per mile. Mats were assumed to be reused six times after initial use. Installation and removal costs were assumed to be equal at $53.72 per mat.

Where existing roads and trails were inadequate to provide reasonable construction access to the ROW and pole locations due to wetlands, temporary access roads were included in the estimate. A total of 38 miles of access road construction and restoration was estimated at $8,596 per mile.

2.5.2 Review Methodology and Comparisons

Wetland area maps prepared by PEI for areas in and along the ROW were reviewed along with other wetland information in the Project documents to confirm the reasonableness of the assumed area of wetlands impacted. Also, the construction approach for wetland protection was reviewed and compared to other similar projects in other parts of the U. S. Unit costs for the materials and installation were reviewed with respect to industry costs and seem reasonable.

2.5.3 Summary and Findings

The level of detail and assumptions used in defining the wetland/accessibility costs appear reasonable given the preliminary wetland assessment mapped for the project with the preliminary pole spotting locations. The assumption for installation of hardwood mats combined with the requirement that all structures installed in wetlands be constructed during winter, frozen soil conditions, is considered a high level of construction mitigation as compared to similar projects in northern climates that use frozen soil/winter construction along with low ground pressure equipment. Given the requirements specified in the Project's Construction and Mitigation Plan and the level of detail provided in the estimate, the wetland accessibility adder appears to be reasonable.

2.6 Mobilization and Demobilization

Mobilization and demobilization include costs for the Contractor to bring equipment, staff, and construction facilities to the project site.

It is also used to prevent the Contractor from front loading units which would inflate the bid units that are constructed first. The mobilization fee will assist the Contractor

with start-up costs, establish a positive cash flow, and will be used purchasing Contractor supplied materials.

Demobilization can be used by the Applicants to insure the Contractor cleans up his project sites. It is basically the cost to remove his equipment and facilities from the project site.

A secondary benefit is if a project were shut down for some unknown reason, this would be the cost for the Contractor to leave and return to the project site.

2.6.1 PEI Values and Methodology

PEI assumed $0.57 million for mobilization and $0.57 million for demobilization for the Wisconsin portion of the project.

2.6.2 Review Methodology and Comparisons

An industry accepted value of 3% is often used in estimates for mobilization and demobilization. This is usually based on direct construction costs. In this case it appears that this cost estimate moved items out of the mobilization/demobilization classification and into other more sustained activities, such as field offices and personnel, a logical breakdown.

2.6.3 Summary and Findings

Mobilization and demobilization, each represent about 0.3% ($0.57 million) of total construction costs. This is a necessary cost item, estimated low, but has an insignificant impact on total cost. The costs seem reasonable.

2.7 Environmental Devices

Environmental devices include aerial marker balls, to protect against aircraft collisions with power lines; and bird flight diverters, to protect against bird collisions with power lines.

2.7.1 PEI Values and Methodology

PEI assumed a material cost of $312 per marker ball and $42 per diverter. Their labor cost for installation (in 2000 dollars) is $133 per marker ball and $89 per diverter.

PEI assumed 780 marker balls and 2400 diverters (the majority are located in the Weston–Bass Lake section).

2.7.2 Review Methodology and Comparisons

Specific sections were not reviewed as to the exact locations of the aerial marker balls and bird flight diverters. There are industry standards and also Federal Aviation Administration (FAA) requirements for specific locations of marker balls for visual

identification by aircraft pilots. Flight paths around aircraft corridors also determine specific requirements. Bird flight diverters are used to prevent bird collisions with power lines in known areas of migration and habitation, which may include certain lakes, streams, rivers, bird sanctuaries or other identified areas. The quantity estimates and locations for these environmental devices were not specifically reviewed but they appear to be a reasonable assumption for the line length and more may be determined to be needed as further study takes place.

2.7.3 Summary and Findings

Environmental devices represent about 0.4% ($0.8 million) of total construction costs.

The installed costs for these devices appear reasonable but the required quantity has not been verified. In any case, the environmental devices represent an insignificant cost component of the project.

2.8 Miscellaneous Construction Items

These include guard structures, winter concrete provisions, concrete blankets, and rock sealing. The latter three items seem to be allocable to foundations.

2.8.1 PEI Values and Methodology

PEI used unit pricing for all miscellaneous construction items from MJE. For guard structures, PEI/MJE estimated 190, 3-pole structures at $3,400 each and 47, 5-pole structures at $5,100 each.

The winter concrete adder of $10.51 per cy was applied to 10,000 cy or about 16% of the foundations for the project. This is based upon the 1,598 structures with a total concrete foundation volume of 61,596 cy. Concrete blankets were added to 100 foundations at an estimated cost of $328 each. Finally, rock sealing was added to all rock foundations (12% of total) with an estimated cost of $2,626 per foundation.

2.8.2 Review Methodology and Comparisons

After discussion with a concrete supplier in Ladysmith, WI, an adder for winter concrete was estimated at $8 per cy to $10 per cy and seems to support PEI's estimate. However, the basis for selecting only 16% of the foundation concrete for winter installation has not been specified. That percentage looks low, given the requirement to work in wetlands during the winter.

2.8.3 Summary and Findings

The unit costs for rock sealing and concrete blankets appear reasonable.

2.9 Contractor Field Office Facilities and Personnel

2.9.1 PEI Values and Methodology

PEI assumed an 18-month construction period, a five-person field office, straight time for 3120 hours, and overtime at 1560 hours for each person.

The costs for a staffed field office for 18 months was assigned to both the St. Louis River–Bass Lake and the Bass Lake–Weston line sections in Wisconsin. It is unclear if the plan is for one 18-month construction period and two field offices running concurrently or for a 36-month construction period and one field office with one move.

PEI also included $4,200 per month for portable offices, $1,200 per month for a 20-acre material yard (four yards total) and $7,000 for yard security at each of the yards.

2.9.2 Review Methodology and Comparisons

The time period assumption, hours and rates of personnel were reviewed based with industry standards and RS Means.

2.9.3 Summary and Findings

Field Office represents about 2% ($4.1 million) of total construction cost.

The labor rates used, the project duration and the allocation of hours over the project life appear reasonable.

Expected staff such as a project superintendent or project manager was not in the list of personnel and it is unclear where this additional staff is included.

The cost of a field office for 18-months charged to two different line sections for the 220.2 mile line is not unusual. PEI assumed the field office for Bass Lake–St. Louis River section would also be used for the St. Louis River–Arrowhead line section for a 208-mile line.

2.10 Construction and Mitigation Plan

Construction and mitigation plan costs include: 1) construction cost premiums associated with the required construction procedures, monitoring and coordination associated with environmental impact mitigation, and 2) independent environmental inspection costs.

2.10.1 PEI Values and Methodology

The Applicants provided estimated costs for the construction and mitigation plan implementation at $6,060,000 for a project in service date of June 30, 2008. These costs are based on approximately one-half being allocated for independent environmental inspection costs and the other one-half for implementation of

mitigation procedures, associated monitoring and coordination by the construction contractor.

2.10.2 Review Methodology and Comparisons

The Construction and Mitigation Plan for the Project was reviewed and compared to typical mitigation procedures for transmission line construction. Estimated costs for inspection and implementation of mitigation measures were reviewed with respect to the nature of the requirements and associated monitoring labor.

2.10.3 Summary and Findings

The estimated cost of $6,060,000 for construction and mitigation plan implementation appears to overlap with construction management costs, which, as discussed below are on the higher end of the range for construction management costs. However, there is a considerable amount of uncertainty with respect to the specific environmental permitting requirements and the amount of effort required for farm disease mitigation. For this reason the level of effort estimated for construction and mitigation plan implementation and monitoring is considered reasonable.

2.11 Construction Management

2.11.1 PEI Values and Methodology

The construction management (CM) cost estimate breakdowns were reviewed on a unit cost basis to determine if assumptions and unit prices are reasonable. Costs for construction management were provided by MJE to PEI. PEI/MJE estimated $9,226,380 for construction management. This includes labor, materials, wetlands accessibility, temporary construction, and farm disease mitigation resulting in a value of 4.76% of the total construction cost. If the $15,000,000 value for farm disease mitigation is removed from the construction cost estimate total, a new ratio of 5.16% for construction management is obtained. PEI used a CM value of about $41,900 per mile for the 220.2 mile project (208 miles in Wisconsin and 12 miles in Minnesota).

2.11.2 Review Methodology and Comparisons

To the extent practical, a comparison was made to the overall cost of the line construction project versus typical construction management percentages of other recent projects and to the 2003 RS Means estimating guide. RS Means estimates construction management as a percent of total construction cost, also. The RS Means values range from 2.5%, for a minimum $5,000,000 project, to a maximum of 4%. Costs range from $23,727 to $37,963 per mile using the RS Means values for CM.

Comparisons were also made between the Arrowhead–Weston line and a similar planned 101 mile 345 kV transmission line in a remote section of the Northeast. Construction management values of 2.2% were estimated for the similar project.

2.11.3 Summary and Findings

Detailed analysis of labor and material values in the construction management lump sum amount were not available so the analysis was based upon industry standard values. For the particular circumstances and assumptions of a project of this magnitude the construction management estimates appear to be above the expected range of 2.5% to 4%. Although the values are slightly above the expected, they appear to be reasonable, especially if farm mitigation is included in the total.

2.12 Clearing Right-of-Way

2.12.1 PEI Values and Methodology

The ROW clearing and restoration cost estimates were reviewed on a unit cost basis to determine if assumptions and unit prices are reasonable. Costs for ROW clearing and restoration were provided by MJE to PEI who developed the total construction cost estimate for the project. PEI/MJE separated this section in two parts, ROW Clearing & Restoration, and ROW Restoration. These were then separated into line sections as follows: Weston–Bass Lake, Bass Lake–St. Louis River, and St. Louis River–Arrowhead. Each of these subsections had unit costs, depending upon the area. A total was given, based upon the projected acreage affected.

The ROW Clearing and Restoration subsections involved restoration in upland or wetland areas with clearing of various types of timber and brush. Costs for removal of danger trees was also estimated.

The ROW Restoration did not involve any clearing, but did have separate units for restoration in non-agricultural areas, cultivated land, hay and pasture land. Other major units included installation of silt fence, farm gates, and access culverts using on site fill. These were estimated in various units such as per foot, per cubic yard, each, or per acre. The units were then totaled and assigned a per acre value as shown in Table 2-1.

Table 2-1
ROW Clearing & Restoration – PEI Estimates

ROW Clearing & Restoration	Acres	Cost per Acre	Totals
ROW Restoration: Weston–Bass Lake	463	$3,996.93	$1,850,579
ROW Clearing & Restoration: Weston–Bass Lake	1321	$1,169.51	$1,544,923
ROW Restoration: Bass Lake–St. Louis River	790	$3,416.79	$2,699,264
ROW Clearing & Restoration: Bass Lake–St. Louis River	696	$1,317.62	$917,064
ROW Restoration: St. Louis River–Arrowhead	7	$6,601.68	$46,212
ROW Clearing & Restoration: St. Louis River–Arrowhead	155	$1,056.01	$163,682
Totals			**$7,221,724**

2.12.2 Review Methodology and Comparisons

The 2003 RS Means estimating guide was used to obtain values for labor, equipment and materials for each of the individual units. The units were adjusted based upon a location factor specific to the region of the United States and each unit was subsequently inflated by 3% per year from 2003 to 2007 for an equal comparison basis with the PEI/MJE estimate. Shown in Table 2-2 are the cost per acre values obtained from RS Means compared with the PEI/MJE estimates. The percentage difference of each unit along with a total percent is shown for this section.

Table 2-2
Cost Per Acre Values – RS Means

ROW Clearing & Restoration	Acres	PEI Cost per Acre Estimate	RS Means Cost per Acre Estimate
ROW Restoration: Weston–Bass Lake	463	$3,996.93	$4,171.95
ROW Clearing & Restoration: Weston–Bass Lake	1321	$1,169.51	$1,702.31
ROW Restoration: Bass Lake–St. Louis River	790	$3,416.79	$3,583.29
ROW Clearing & Restoration: Bass Lake–St. Louis River	696	$1,317.62	$1,805.3
ROW Restoration: St. Louis River–Arrowhead	7	$6,601.68	$7,728.74
ROW Clearing & Restoration: St. Louis River–Arrowhead	155	$1,056.01	$1,680.82
Totals Using Cost Per Acre		**$7,221,724**	**$8,546,723**

For additional comparison, a similar 345 kV transmission line project in a remote section of the Northeast had estimated values for ROW clearing and access roads of 20.21% of the total construction cost estimate. PEI/MJE used $7,221,722 for ROW clearing and restoration and $15,474,928 for Wetlands Accessibility for a total of $22,696,650 for ROW clearing and access roads. This results in 10.86% of the total construction cost of $208,987,118 for the Arrowhead–Weston line.

2.12.3 Summary and Findings

For the particular circumstances and assumptions of a project of this magnitude the ROW clearing and restoration estimates are below the expected range. Although the values are lower, they appear to be reasonable.

2.13 Land Rights-Easements

2.13.1 PEI Values and Methodology

The cost estimate breakdowns were reviewed on a cost per mile basis to determine if assumptions and pricing are reasonable. Costs for Land Rights – Easements in fee (meaning the Applicant's will purchase the ROW for the line) were provided by PEI who developed the total project cost estimate. PEI separated this section into two parts, ROW Acquisition and Legal Assistance with Acquisition. The ROW Acquisition was then separated into the Wisconsin and Minnesota line sections. The land costs from the PEI assumptions sheet, list a cost per acre of $2,500, which results in approximately $36,364 for a 120 ft. ROW. The Wisconsin line section is 208.3 miles (3030 acres) and the Minnesota section is 11.9 miles (173 acres). Per mile cost for Wisconsin is $104,000 and Minnesota is $34,000. Legal Assistance is listed at $9,000 per mile. Total costs for the land rights easement are listed as $23,942,500, which breaks down in cost per mile to $108,731 or $7,475 per acre. PEI stated a contingency value of 25% for the ROW costs section.

2.13.2 Review Methodology and Comparisons

Review methodology involved comparing the PEI estimates to a similar remote transmission line project involving the purchase in fee of ROW along a new route. Actual bid values for the ROW acquisition services and an assumed land value of $2,500 per acre were compared with the PEI estimates.

Comparison of the projects revealed a total cost for a 120 ft. wide ROW purchase in fee and acquisition services of $5,023 per acre or $73,060 per mile.

2.13.3 Summary and Findings

Land purchase values of $2,500 per acre for a project of this magnitude over the varying land types of this route is a generally accepted number in this area of the U.S. This value can be substantiated by local realtors, and therefore appear reasonable. The

PEI stated contingency of 25% for ROW costs is considered a typical industry value and appears reasonable.

Detailed ROW acquisition costs were not available so the analysis was based upon a similar project. For the particular circumstances and assumptions of a project of this magnitude the PEI ROW cost of $7,474 per acre compares to our analyzed value of $5,023, which reflects a value approximately 49% higher (24% above accepted 25% contingency) than expected.

Uncertainty of the large number of landowners impacted by this project and varying perceived land values by each landowner may be the cause of the higher than expected values. But they seem high, never the less.

2.14 Removal

Removal refers to the demolition and removal associated with 345 kV and lower voltage transmission lines that utilize wood structure construction.

2.14.1 PEI Values and Methodology

PEI developed two estimating items for removal of wood pole lines at 69-230 kV and wood poles lines at 345 kV. They broke down the cost into removal of phase conductors, removal of overhead shield wire, and H-frame structures (assumed 9 per mile). PEI states that the number of structures to be removed per mile was adjusted based on an MJE estimate for lines in Minnesota.

PEI's unit cost per circuit mile to remove the 69-230 kV wood pole lines is $25,700 /mile assuming nine structures per mile. This includes $8,000 to remove three phase conductors, $4,800 to remove two shield wires, and $12,900 to remove nine structures (PEI estimate says 161 kV H-frames and that looks to be in error).

The unit cost to remove a 345 kV wood pole line is $43,700 per mile assuming 16 structures per mile and 2/c bundles. This includes $15,900 to remove six phase conductors, $4,800 to remove two shield wires, and $23,000 to remove 16 structures (PEI estimate says 161kV H-frames and that looks to be in error).

There is some discrepancy in item descriptions for the removal items in the PEI cost estimate.

PEI applied the 69-230 kV removal item to 85 miles of line and the 345 kV removal item to 4 miles of line.

2.14.2 Review Methodology and Comparisons

Comparisons were made between the cost to remove wire and the cost to install it. The LME cost to install a circuit-mile (three wires) is about $32,800 in the PEI estimate. This is four times the cost of removal which is a reasonable ratio.

The structures to be removed are bare, with no wires attached, and directly embedded. H-frame bracing, insulator assemblies and guy assemblies must be detached and

removed. Then the poles can be shaken and plucked out of their holes rapidly with the correct equipment and then laid on a pole trailer with a crane. Then the pole holes must be backfilled. A contractor should be able to demolish structures for one-mile of line in a day depending on land type.

Review methodology also involved comparing the PEI estimates to actual bid values for two different 115 kV H-frame transmission lines in Alaska. Construction and removal of one line was in an environmentally sensitive area along wetlands and mountainous terrain in summer conditions at an approximate removal cost of $40,521 per mile. The second 115 kV line was also in an environmentally sensitive area along wetlands over flat terrain in winter (frozen ground) conditions at an approximate removal cost of $30,423 per mile. These removal costs included conductor, poles, cross-arms, x-braces, and guy wire, but no shield wire.

2.14.3 Summary and Findings

Removal represents about 1% ($2.4 million) of total construction costs. The PEI estimates for removal appear reasonable and within the expected range compared to similar transmission projects.

2.15 Salvage

Salvageable items include insulators, hardware, guys, and conductor resulting from the demolition of transmission lines from 69 thru 345 kV and result in a small credit to the project.

2.15.1 PEI Values and Methodology

PEI estimated a salvage value of $280 per mile for 69-230 kV lines and $8,700 per mile for 345 kV lines.

2.15.2 Review Methodology and Comparisons

No detailed review was done for this line item. It is not possible at this time to judge the condition of removed material and equipment and its potential for re-use.

2.15.3 Summary and Findings

Salvage represents a credit of about 0.03% ($0.06 million) of total construction costs.

The only material normally salvaged is the poles and then, only if they have been recently installed (within the last year). The cross-arms, x-braces, and guy wire are normally not reused. Conductor and shield wire is never reused for another line due to the unknown loads that may have been imposed upon it. If an ACSR (aluminum conductor steel reinforced) conductor is sold for scrap, the steel is generally separated from the aluminum which is labor intensive and decreases the value.

At times, if the removed poles are given to landowner that is impacted by the line construction, the cost benefit may be in the form of customer satisfaction and part of the easement negotiations.

Salvage represents a minor cost element and changes to the assumptions for salvage will have a very minor impact on construction costs.

2.16 Local Engineering

2.16.1 PEI Values and Methodology

The values supplied in the PEI report came from the Applicants and cover three main areas, Applicants Cost, Public Information and Community Outreach, and Costs Associated with Oversight and Access. The Applicants Cost section was separated in two parts, Cost Expended to June 6, 2002, and Cost to Complete for Applicants. The Local Engineering cost totaled $16,571,841.

2.16.2 Review Methodology and Comparisons

A detailed cost estimate for ATC's Global Oversight listed the personnel classifications in Full Time Equivalent (FTE's) Employees by percentage and for the duration of the project. FTE unit classifications were separated into Executive Oversight, Regulatory/Siting & Communication, Engineering & Project Management, Accounting/Supply Chain & Internal Audit, Real Estate, Environmental, System Operations, and Planning. The Executive Oversight and office staff were listed as full time positions and the other FTE units were listed as a percentage.

In total, 5.1 FTE's were listed through 2007. The most recent cost estimate had extended the values to 2008. Expenses were assumed to be 33.3% of personnel costs. An inflation factor for FTE salaries of 3.5% per year through 2005 was listed.

Cost breakdowns for the other Applicants were not available but were assumed to be similar to costs submitted by ATC, an Applicant. Using this assumption, the other Applicants cost values were analyzed, resulting in an additional 6.3 FTE employees for a total of 11.4 FTE's for the 6.5 year project. If the $3,000,000 estimate for ATC's Public Information and Outreach and the $750,000 estimate for Costs Associated with Suits and Access are subtracted from the overall Local Engineering costs, the result is $12,821,841. The resulting Local Engineering value is equated to a common industry term called Owners Overhead Expense. If the Owners Overhead Expense is taken as a percentage of the total project cost, a value of 3.05% is obtained.

A typical value for Owners Overhead Expense in the transmission industry is 3% of the total project cost.

2.16.3 Summary and Findings

A detailed analysis of all the values in the Local Engineering (Owners Overhead Expense) amount was not available, so the analysis was based upon typical industry

values. For the particular circumstances and assumptions of a project of this magnitude the 3% Owner Overhead Expense is typical, and it appears to be reasonable.

2.17 Foreign Engineering

2.17.1 PEI Values and Methodology

The values supplied for Foreign Engineering were supplied by PEI who developed the total construction cost estimate for the project. It covers four main areas: Engineering Design & Project Management, Ground & Aerial Survey, Soils Investigation, and Engineering Studies. A detailed analysis of the costs was not available, but some costs were assumed to be on-going and some appear to be costs spent to date, such as the Soils Investigation.

The Engineering Design and Project Management subsection of the Foreign Engineering section listed a value $6,782,160 or $30,800 per mile.

Ground and Aerial Survey unit costs totaled $7,861,140 and $418,380, respectively. In per mile units, the ground survey is $35,700 and the aerial survey is $1,900.

Soils Investigation lump sum cost of $748,680 was provided with no detailed breakdown. Since the soils investigation has already taken place over the majority of the route, this may be a cost incurred to date.

Engineering Studies amounted to $286,260.

The above listed values totaled $16,096,620 for the Foreign Engineering cost.

2.17.2 Review Methodology and Comparisons

Costs comparisons were made separately for three of the main areas, Engineering Design & Project Management, Ground & Aerial Survey, and Soils Investigation. The percentage value for the whole section was also compared to the total construction cost. Because of limited information, the Engineering Studies section was not compared, since some of the study items are still being developed. To the extent practical, a comparison was made to the total line construction project versus typical percentages of other recent projects and to the 2003 RS Means estimating guide.

RS Means estimates Engineering Design costs in the range of 2.5% to 10.10%. Engineering Design and Project Management subsection of the Foreign Engineering section listed a value $6,782,160 out of the total Construction Cost ($208,987,118), resulting in a value of 3.2%. Without the Farm Disease Mitigation, the value is 3.8%. Engineering estimates for a similar project were approximately 3% of the total construction cost estimate.

Costs for field survey and aerial survey were compared in two ways which resulted in a range of percentage values on a cost per acre basis. RS Means estimates Field Survey costs at $2,800 per acre and aerial survey at $91 per acre for a 100 acre minimum. Review methodology involved comparing the PEI estimates to a similar

remote transmission line project in Ohio involving the survey work along a new route. Actual bid values for the field and aerial survey services were $1,606 and $140 per acre, respectively. The PEI cost per mile estimates were evaluated on a cost per acre of $2,454 for ground survey and $131 for aerial survey.

PEI had soils data for 281 locations along the 220.2 mile route. This resulted in a cost per boring of $2,664. The Soils Investigation costs were examined using RS Means and were assumed to have specific testing units for each soil boring. This resulted in a value of $1,430 per boring.

A 7.7% value resulted when the $16,096,620 for the total Foreign Engineering section is compared to the total Construction Cost. RS Means lists percentages in the range of 2.5% to 10.10% for Engineering Design.

2.17.3 Summary and Findings

A detailed analysis of all the values in the Foreign Engineering amount was not available, so the analyses were based upon typical industry values.

The Engineering Design and Project Management costs are in the range of expected values as compared to RS Means and to similar projects. They appear reasonable.

Survey costs of $2,585 per acre were found to be slightly above typical in the analysis and appear to be reasonable. The evaluation range was $1,746 per acre to $2,891 per acre.

Soils Investigation costs were higher than expected; however, the values may be justified. Since the soils borings along the route have been performed, this is likely a cost to date.

Information regarding the Engineering Studies was not provided, but the value appears reasonable based upon the magnitude and complexity of this large transmission project.

Overall the 8.31% for the total Foreign Engineering section compared to the total Construction Cost is within the expected 2.5% to 10.10% range and it appears to be reasonable.

2.18 Project Licensing Costs

Project licensing costs include costs that have been expended, project to date, for environmental studies and licensing and costs yet to be expended for securing permits and approvals. The licensing activities are the responsibility of the Applicants. Table 3-1 in the Construction and Mitigation Plan for the Project dated September 2002 provides a list of permits and approvals required.

2.18.1 Applicants Values and Methodology

As stated in the May 23, 2003 Cost Estimate Audit Report, Revision 1, and confirmed in a telephone conversation with ATC on June 30, 2003, the Applicants have incurred

at least $8,239,000 in licensing costs through the spring of 2003. This amount excludes local engineering costs incurred prior to December 31, 2001, which were assumed to be licensing costs. This exclusion is noted in the Assumptions Sheet of PEI's May 6, 2003 estimate.

Since most of the permits and approvals required by the Project have yet to be secured, significant licensing expenses are required prior to construction. ATC stated, in the telephone call noted above, that licensing costs were included as part of the Local and Foreign Engineering costs estimates, and that such costs could exceed $20,000,000.

2.18.2 Review Methodology and Comparisons

Various cost reports and licensing documents were reviewed, including the Final Environmental Impact Statement (October 2000), the Construction and Mitigation Plan – Part A (September 2002) and various cost estimate reports. The magnitude of these costs was compared to similar transmission line construction projects.

2.18.3 Summary and Findings

The $8,239,000 licensing cost incurred over the last year and one-half coupled with estimated $20,000,000 to complete the licensing puts the total licensing cost in the range of $20,000,000 to $30,000,000, or approximately 10 to 14% of the total line construction cost of $208,987,118. This equates to approximately $89,000 to $134,000 per mile. If compared to a similar 345 kV line project in the Northeast where the project licensing cost was 3.5% of the construction cost at $7,400 per mile, the licensing costs appear to be high.

Future licensing costs are not specifically identified in the latest revised cost estimates provided by the Applicants. Rather, it is understood that such costs would be included as part of the Local and Foreign Engineering costs. Estimated total costs for Local and Foreign Engineering are $16,571,841 and $16,096,620, respectively. As stated above, in the discussion of these cost components, these engineering costs appear to be reasonable for the typical costs associated with owner's engineering costs and design engineering costs. However, if $20,000,000 or more is required for securing the Project permits and approvals, the overall estimate for Local and Foreign Engineering is low.

2.19 Substation Costs

2.19.1 Weston Substation-New South Site Estimates

The estimate of probable cost for the Weston 345/115 kV Substation prepared by Electrical Consultants, Inc. (ECI) is provided in Table 2-3.

Table 2-3
Weston 345/115 kV Substation – Probable Cost

Equipment	Estimated Cost
New 345 kV Switchyard: Breaker and one half; 4 positions, 8 future, with two 500 MVA 345/115 kV transformers	$12,597.612
Reactor for 345 kV switching	$2,134,045
Capacitors	$1,041,287
New 115 kV Switchyard: Breaker and one half; 10 positions	$6,572,931
Existing 115 kV switchyard modifications	$204,171
Line construction between switchyards	$2,778,543
Inflation to year of expenditure	$1,175,789
Total	$26,504,378

2.19.1.1 Summary and Findings

The costs appear to be reasonable based on comparison of cost for substations of similar size and capacity using recent material and construction costs.

2.19.2 Stone Lake Substation Estimates

The estimate of probable cost for the Stone Lake Substation prepared by ATC is provided in Table 2-4.

Table 2-4
Stone Lake Substation – Probable Cost

Equipment	Estimated Cost
New 345 kV temporary substation	$4,399,685
Remove temporary substation	$84,413
Salvage value of removed equipment	($1,911,439)
Existing substation upgrades	$1,608,114
Total	$4,180,773

2.19.2.1 Summary and Findings

The costs for the new temporary substation appear to be reasonable based on comparison to costs of substations of similar size and capacity.

It appears that some contingency has been included in the cost of the material and construction. This contingency could be as high as 20% on some items.

The cost for the existing substation upgrades appears to be high if only the circuit breakers are being replaced. The cost to upgrade the four (4) 161 kV circuit breakers

is given as $1,608,114. The cost for a typical 161 kV, 2000 A, 40 kA circuit breaker is typically $75,000 with labor and miscellaneous material approximately $20,000 for a total cost for four (4) breakers being approximately $380,000.

2.19.3 Arrowhead 345/230/115 kV Substation

The estimate of probable cost for the Arrowhead Substation is $26,119,350. This is composed of an estimated cost of $23,534,424 for the estimated cost plus $2,584,926 for inflation. There is no reference in the cost estimate to indicate the origin of the document.

The estimate provided listed broad categories of cost items, but was not detailed like the Weston Substation. Although a detailed cost estimate with specific material quantities and sizes was not provided, an assumption may be made that the Arrowhead Substation units are similar to the detailed Weston Substation which was found to be reasonable.

2.20 AFUDC

2.20.1 PEI Values and Methodology

The review of the Applicant's AFUDC calculation consisted of obtaining the actual AFUDC worksheet and verifying the methods used to calculate the AFUDC. The Applicant used the weighted average cost of capital (WACC), assuming a debt to equity ratio of 50%. This ratio is similar to the actual capitalization ratio found in the Applicant's 2001 Federal Energy Regulatory Commission (FERC) Form 1 of approximately 57% equity and approximately 43% debt.

2.20.2 Summary and Findings

The cost of equity utilized in the calculation was 12.2%, which is the FERC regulated rate for the Applicant's actual allowed return on equity. The cost of debt utilized in the calculation was 7.4% through 2003, and then varied between 3% and 3.5% over the remaining period.

One apparent error was found in the calculation of AFUDC. In determining the equity portion of the AFUDC for the Weston Substation portion of the project, the Applicant utilized a monthly interest rate of approximately 1% while the Construction Work in Progress (CWIP) for which the AFUDC was being estimated was a quarterly estimate. Using the correct quarterly rate of approximately 3.1% yielded an increase in the estimated AFUDC for Wisconsin from approximately $56,400,000 to approximately $57,904,000.

Other than the apparent calculation error noted above, the AFUDC appears to have been estimated in accordance with FERC guidelines.

2.21 Environmental Impact Fee

The environmental impact fee is a surcharge mandated by the State of Wisconsin for the portion of the Project located in Wisconsin. The surcharge is 5% of the total licensing and construction costs for the transmission line and substations as completed.

2.21.1 PEI Values and Methodology

Based on an in-service date of June 30, 2008, the Project licensing costs incurred to date of $8,239,000 the estimate construction costs for the transmission line and substations of $289,721,154 and the estimated AFUDC of $49,259,174 the environmental impact fee is $17,360,966.

2.21.2 Summary and Findings

The calculated environmental impact fee of $17,360,966 is directly dependent on the final as-built construction costs for the project. To the extent such costs are higher or lower than those estimated in May 23, 2003, the environmental impact fee will be proportionally lower or higher.

2.22 Farm Disease Mitigation

A significant issue that has recently been identified during the evaluation of the Arrowhead–Weston Project is the issue of farm disease mitigation. Recent concerns of livestock and crop diseases have raised the level of concern for the potential spread of such diseases due to construction activities. Construction vehicles and construction labor will be traversing the transmission line ROW through pasture areas and agricultural fields that could be contaminated by such diseases. Research on the presence of farm disease in this area of the U.S. is in early development stages. Very little information is currently available concerning the risk of spreading such diseases through vehicle, equipment and personnel contamination and the approach for mitigating such contamination through vehicle, equipment and personnel decontamination. For these reasons, the mitigation approach and associated cost for the Project are uncertain.

2.22.1 PEI Values and Methodology

In PEI's May 6, 2003 Engineers Cost Estimate for the Arrowhead–Weston Project, an estimate of $15,000,000 for farm disease mitigation is included for the Weston–Bass Lake section of the Project. This estimate was provided to PEI by the Applicants based on investigations and reviews with federal and state agricultural officials. According to ATC, this value is believed to be a mid-point of estimated costs for mitigation approaches necessary to address the farm disease issue. Because of the uncertainly associated with this issue, the mitigation costs could vary widely.

2.22.2 Summary and Findings

Farm disease mitigation is a new issue that was recently identified during the review of the Arrowhead–Weston Project. The Applicants and PEI have investigated this issue and consulted with agricultural officials to define the required mitigation and associated costs. Based on these investigations a lump sum estimate of $15,000,000 has been allocated for farm disease mitigation, which is considered reasonable at this time. However, due to the magnitude of costs involved and the uncertainty, further investigation is warranted.

Section 3
ARROWHEAD–WESTON CONTINGENCY VALUES

3.1 PEI Values and Methodology

No single contingency value as a line item was assumed for the overall construction cost estimate. Some of the line items listed contingency of 25%.

3.2 Review Methodology and Comparisons

Due to single line item values being listed in the overall construction cost estimate analysis of contingency values used is difficult. Projects of this size and scope normally have a contingency value listed as a percent of construction.

RS Means estimates contingency values in four categories as follows:

- Conceptual Stage 20%
- Schematic Stage 15%
- Preliminary Working Drawing Stage 10%
- Final Working Drawing Stage 3%

For comparison purposes, this project would still be in the Conceptual Stage since survey, permits, structure location, ROW purchase, and the structure design are still in this stage. Although preliminary structure designs have been completed, terrain contingencies identified during surveying, along with ROW purchase may present additional design constraints.

For a project of this size and scope, value engineering would also be expected to identify areas where cost savings could be implemented.

3.3 Summary and Findings

While a value in this schematic stage was not specifically given, an expected reasonable value for contingency would be 15%.

Section 4
KING–WESTON ROUTE

In the following Section, the total line construction cost of $208,740,239 used for the evaluation includes labor and materials for the transmission line, farm disease mitigation, and temporary line construction. The total project cost of $386,707,671 used for the evaluation includes project licensing, transmission line, clearing, land rights – easements, removal, salvage, substations local and foreign engineering, environmental impact fee, and AFUDC. Both of these values were taken from the May 23, 2003 B&V Cost Estimate Update Report, Revision 1.

4.1 Structures

The route alignment for the King–Weston Route section, Option 10(1), also called the I-94 Route was not defined in the same detail as the Arrowhead–Weston line route. Specific corridors were selected to follow along Interstate 94, and parallel existing 345 kV, 161 kV, and 115 kV transmission lines. The alignment utilizes the approved route for the Arrowhead–Weston Project from a point of Withee, Wisconsin to Weston Substation.

4.1.1 B & V Values and Methodology

Black & Veatch (B&V) used the steel structure costs developed by PEI to begin the estimate. PEI obtained the input from Thomas & Betts, a major steel structure supplier in the U.S. The structure unit prices include material and labor costs for the tubular steel structures, foundations, insulator and hardware assemblies, dampers, grounding, and aerial patrol signs. Since structure spotting has not been performed, B&V assumed that all single circuit 345 kV structures were 110 feet tall and double circuit 345 kV structures were 130 feet tall.

This alternative route is located on existing transmission line ROW to the greatest extent possible. All suspension structures were assumed to use "I"-string insulator configurations. Along this route are 345/115, 345/161, and 345/345 kV double circuits. Because of minimal differences in costs among the different voltages of the double circuits, the 345/345 kV structure costs were used for all double circuit construction estimates. Foundations were also estimated since soil data and specific loading criteria were not available.

This route consists of approximately 93.6 miles of single circuit and 73.1 miles of double circuit. B&V estimated 683 single circuit structures (7.3 per mile) and 521 double circuit structures (7.13 per mile) which is approximately 724 foot and 741 foot spans, respectively. B&V estimated structure costs of $74,431,560. By percentages, 56% of the structures are single circuit and 44% are double circuit. Of the single

circuit, 87% are estimated to be tangent (no line angle) structures and the remaining are small, medium, large angle, or dead-end type structures. B&V estimated that 504 or 97% of the double circuit sections to be tangent type structures.

4.1.2 Review Methodology and Comparisons

For comparison purposes, the GIS data supplied was used to review the selected route along the 61.6 miles, I-94 corridor, following the interstate on a route approximately 185 feet North of the highway centerline. This assumes a 250 foot interstate ROW, 125 feet to the ROW (fence line) edge, and the structure centerline placed 60 feet to the North of the ROW. This also assumes the Wisconsin Department of Transportation will not allow the conductors to encroach upon the highway ROW under any loading conditions. Structures were spotted every 700 feet for single circuit sections and every 800 feet for double circuit sections, which are typical span lengths for these types of circuits. Deflection angles of the line were taken into account and structure types and quantities were estimated. For the other portions of the route, the number of structures per mile was estimated using the same percentages used on the Arrowhead–Weston route. Other considerations, such as an approximate quantity of dead-end type structures, section types, and line miles of each section were taken into account to estimate the number of structures along this alternative route. It is typical in the industry to place dead-end type structures every 5 miles to prevent catastrophic cascade events.

The number of structures estimated for this route totaled 1211, 679 for the single circuit and 532 for the double circuit.

4.1.3 Summary and Findings

Performing the structure spotting by following the I-94 corridor resulted in a higher percentage of angle structures than what B&V estimated. This resulted in a total cost of $77,500,020, which is 4% higher than what B&V estimated. This also does not include special structures to cross the St. Croix River or to have an underground segment in the line by attaching it to the I-94 St. Croix River bridge. The overhead crossing alone could be several million dollars and the underground may be in the 10 million dollar range. Significant permitting problems would also need to be addressed.

The methods and estimates used for the total number of structures by B&V are in the range of expected values and appear reasonable; however, two potentially large items are omitted.

4.2 Foundation Adders

4.2.1 B & V Values and Methodology

B&V used the same methods as PEI to estimate quantities for unstable hole digging and for rock excavation. The estimates include casings for unstable hole digging for

all the foundations. It includes 10 feet of rock excavation for 12% of the foundations. B&V estimated $5,002,090 for foundation adders.

4.2.2 Review Methodology and Comparisons

Development of costs for the foundations were performed by building up costs, based on standard industry estimating guidelines in the Arrowhead–Weston cost review. Soil boring records and foundation assumptions were briefly reviewed in the cost estimate prepared by PEI for the Arrowhead–Weston route.

Due to limited soil information and since no soils information along this alternative route is available, a detailed analysis of all the values in the Foundation Adders amount was not available. Since they are not available, the analyses were based upon typical industry values.

4.2.3 Summary and Findings

The foundation problems of unstable holes and rock excavation are expected based on similar project experience and is substantiated by soil borings on the order of every mile for the Arrowhead–Weston line. The extensive soil investigation along the Weston–Bass Lake portion of the Arrowhead–Weston line route should provide a reasonable design basis for analysis, since it appears to be the same type of terrain. Soils information though, can vary significantly even in areas of close proximity.

The methods and estimates used for Foundation Adders by B&V are in the range of expected values as compared to RS Means and to similar projects and they appear reasonable.

4.3 Counterpoise Wire for Added Grounding

4.3.1 B & V Values and Methodology

This unit includes furnishing and installing extra ground wire to achieve project design goals for resistance to ground when ground rods do not provide sufficient grounding. B&V used the same methods as PEI to estimate quantities for the counterpoise wire length. The 1000 feet of additional counterpoise per mile of line length is based on soil resistivity readings taken for the Arrowhead–Weston route and has been used as a similar approach for this estimate. B&V estimated $721,811 for additional counterpoise wire.

4.3.2 Review Methodology and Comparisons

Grounding costs and assumptions were reviewed in the cost estimate prepared by PEI for the Arrowhead–Weston route. Grounding costs were evaluated using the 2003 RS Means and comparisons made to the PEI estimates.

4.3.3 Summary and Findings

The methods and estimates used for counterpoise wire by B&V are in the range of expected values as compared to RS Means and to similar projects and appear reasonable.

4.4 Wire

The category description of wire in this report refers to the total labor and material for a complete installation of conductor and shield wire. The cost of wire includes the price of conductor, stringing the conductor on the structures, sagging (tensioning the conductor to a pre-determined sag), clipping (attaching the conductor to the insulators on the structures), and splicing (connecting two pieces of conductor together). It also includes installation of spacers in mid-span.

4.4.1 B & V Values and Methodology

Two shield wires were assumed for both the single and double circuits, one is a 7/16" extra high strength (EHS) and the other an optical ground wire (OPGW) with 12 fibers for communications. The phase conductors for all voltages were assumed to be 954 kcmil (kcmil = 1000 circular mils) ACSR Cardinal.

Three 954 kcmil conductors, one for each phase was assumed for 230 kV and below circuits. A bundle of two 954 kcmil conductors per phase were assumed for all single circuit 345 kV circuits. Twelve 954 kcmil conductors were used for the double circuit 345 kV circuits. B&V assumed 166.7 miles of shield wire, 64.5 miles of 954 kcmil for the 230 kV and below lower voltage side of the double circuits, 158.1 miles for the 345 kV side of double circuits or 345 kV single circuits, and 8.6 miles of the double circuit 345 kV.

B&V used the existing values taken from the Arrowhead–Weston line route. B&V estimated $23,997,911 for the conductors and shield wire.

4.4.2 Review Methodology and Comparisons

The unit material costs supplied in the Arrowhead–Weston line route were reviewed and appeared to be reasonable. The lengths based upon the route were reviewed for the route lengths by type of circuit. These costs were verified in the cost estimate and one discrepancy was found in the entry for the 954 kcmil conductor for the 230 kV voltages and below (Estimate Unit #40).

4.4.3 Summary and Findings

If the correct entry is input into the cost data, the B&V cost for conductors and shield wire would be $23,633,874. This results in a difference of $364,037.

Although an entry discrepancy was found in the B&V spreadsheet, the overall methods and estimates used for Conductor and Shield Wire are in the range of

expected values as compared to RS Means and to similar projects and appear reasonable.

4.5 Wetlands Accessibility Adder

4.5.1 B & V Values and Methodology

B&V used the average per mile cost for wetland accessibility adder for the Arrowhead–Weston Project multiplied by the ratio of the wetlands along the Arrowhead–Weston line route to the alternative route being estimated. Wetland values were obtained from the "Environmental Review of Phase 2 Wisconsin Interface Reinforcement Enhancement Study (WIRES) for the Wisconsin Reliability Assessment Organization (WRAO)" of the WRAO report. This document was included as Appendix C of the May 23, 2003 Cost Estimate Update Report, Revision 1. It is noted that in the text of this report, Table 4.5.-1 – Ratio of Wetlands includes values for the percent of wetlands for each alternative, with the Arrowhead–Stone Lake–Weston (Option 3J) at 43.81% wetlands as compared to the King–Eau Claire–Weston (Option 10(1)) at 24.6% wetlands. Therefore, the ratio of Option 10(1) to Option 3J was 56.1%.

4.5.2 Review Methodology and Comparisons

The Appendix C to the May 23, 2003 Cost Estimate Update Report was reviewed to confirm the relative percent of wetlands for each Option. Option 10(1) includes 3% wetlands for the King–Eau Claire segment (65 miles) and 8% wetlands for the Eau Claire–Weston segment (91 miles). Thus the weighted average amount of wetlands for Option 10(1) is approximately 6%. For Option 3J, the Arrowhead–Ladysmith (109 miles) segment includes 20% wetlands and the Ladysmith–Weston 2 (92 miles) segment includes 15% wetlands. Thus the weighted average amount of wetlands for Option 3J is approximately 18%. (It is noted that actual lengths of the routes being compared here are based on the line lengths included in Appendix C and actual final route lengths are slightly different.)

Therefore the calculated wetland ratio of Option 10(1) to Option 3J is 33.4%, as compared to B&V's statement of 56%.

Using the estimated wetland accessibility adder cost from the updated May 6, 2003 PEI cost estimate in the amount of $15,474,928 and the final line length of 220.2 miles results in an average cost per mile for wetland accessibility adder of $40,051 per mile for the Arrowhead–Weston line route. Using this value and the above stated ratio of 33.4%, the estimated wetland accessibility adder for the King–Eau Claire–Weston (Option 10(1)) alternative route is $13,388 per mile.

4.5.3 Summary and Findings

Review of the May 23, 2003 Cost Estimate Update Report, Revision 1 appears to indicate that values assumed for wetland percentages along the Arrowhead–Weston 2

route (Option 3J) and the King–Eau Claire–Weston route (Option 10(1)) are misstated. Review of values in Appendix C to that report indicates that the ratio of wetlands along Option 10(1) to the wetlands along Option 3J is 33.4%. If indeed B&V used 56% as the wetland ratio, rather than 33.4%, it is estimated that the Option 10(1) wetlands adder cost will be reduced by over $1,409,936.

4.6 Mobilization and Demobilization

4.6.1 B & V Values and Methodology

B&V used the existing values for mobilization and demobilization taken from the Arrowhead–Weston line route and divided the values by the line length of 220.2 miles. PEI estimated for the Arrowhead–Weston line route a mobilization and demobilization for two sections, one for Weston–Bass Lake and one for Bass Lake–the St. Louis River. The Minnesota line section was included in the Bass Lake–St. Louis River section. PEI estimated a unit cost of $285,110 for each mobilization and demobilization for a subtotal of $570,220 and a grand total of $1,140,441. B&V's total was $926,579.

4.6.2 Review Methodology and Comparisons

The unit costs supplied in the Arrowhead–Weston line route were reviewed and appear to be reasonable. The lengths based upon the route were reviewed and these costs were verified in the cost estimate and one discrepancy was found in the entry for the per mile cost. If the $570,220 is divided by 220.2 miles, the result is $2,590 per mile. B&V used a value of $2,779.

Review of other similar projects listed mobilization as high as 2% for installation of structures, foundations, conductor, and miscellaneous items. Demobilization was listed as ½%. The total of the structures, foundations, conductor, and miscellaneous items only is $107,794,619 and using the ½% to 2% range, the costs could be $538,973 to $2,155,892.

4.6.3 Summary and Findings

Although an entry discrepancy was found in the B&V spreadsheet, the overall methods and estimates used for mobilization and demobilization are on the low side of expected values as compared to similar projects.

B&V has reduced the PEI/MJE estimate on a per mile basis. Since this was a bid value and MJE planned to have two separate mobilizations and demobilizations (construction field offices also) per 90-120 miles of line constructed, it seems the PEI/MJE value should not be reduced. The PEI/MJE estimated bid unit cost of $285,110 for each mobilization and demobilization for a subtotal of $570,220 and a grand total of $1,140,441 should probably be used.

4.7 Environmental Devices

4.7.1 B & V Values and Methodology

B&V used the existing labor and material values for environmental devices taken from the Arrowhead–Weston line route and divided the total amount by the line length of 220.2 miles to develop a per mile cost. PEI estimated lump sum costs for the different line sections of $811,008 for material and $1,079,569 for contractor labor, material and equipment for a total of $1,890,577. B&V's used $588,598 for material and $794,227 for a total of $1,382,825.

4.7.2 Review Methodology and Comparisons

The unit costs supplied in the Arrowhead–Weston line route were previously reviewed and appeared reasonable. The lengths based upon the route were reviewed and these costs were verified in the cost estimate and discrepancies were found in the entries for steel and contractor labor, material and equipment.

If the $811,008 for material and $1,079,566 for contractor labor, material and equipment (LME) are divided by the 220.2 mile line length, the result is $3,683 and $4,903 per mile, respectively. B&V used a value of $3,531 for material and $4,765 for LME.

4.7.3 Summary and Findings

If the correct entry is input into the cost data, the B&V cost for environmental devices is $1,431,240. This results in an increase of $48,415.

The number of marker balls total 1,460 and are typically placed near airport approach paths and over rivers or stream crossings. Per mile that equals 6.6 or approximately 3 in 2 spans per mile. For the 166.7 mile route the total number would be 1,105 at a cost of $497 for a grand total of $549,482.

Although an entry discrepancy was found in the B&V spreadsheet, the overall methods and estimates used for the environmental devices are in the range of expected values as compared to RS Means and to similar projects and appear reasonable. Without identifying the exact areas where bird flight diverters and marker balls are required the B&V approach is a reasonable assumption with the corrected values.

Specific sections were not reviewed as to the exact locations of the aerial marker balls and bird flight diverters. There are industry standards and also Federal Aviation Administration (FAA) requirements for specific locations of marker balls for visual identification for aircraft pilots. Flight paths around aircraft corridors also determine specific requirements. Bird flight diverters are used to prevent bird collisions with power lines in known areas of migration and habitation, which may include certain lakes, streams, rivers, bird sanctuaries or other identified areas. The quantity estimates and locations for these environmental devices were not specifically reviewed but they

appear to be a reasonable assumption for the line length and more may be determined to be needed as further study takes place.

4.8 Miscellaneous Construction Items

4.8.1 B & V Values and Methodology

These include guard structures, winter concrete provisions, concrete blankets, and rock sealing. The latter three items were identified by MJE as possible additional units that should be placed in the bids.

B&V used the existing labor and material values for miscellaneous construction items taken from the PEI Arrowhead–Weston line route and divided the total amount by the line length of 220.2 miles to develop a per mile cost. PEI estimated unit price items for the different line sections without any material cost and $1,630,235 for contractor labor, material and equipment. B&V's used $5,122 per mile for a total cost of $853,906.

4.8.2 Review Methodology and Comparisons

The unit costs supplied in the Arrowhead–Weston line route were previously reviewed and found to appear reasonable. The lengths based upon the route were reviewed and these costs were verified in the cost estimate and discrepancies were found in the entries for the contractor labor, material and equipment.

If the $1,630,237 for contractor labor, material and equipment (LME) are divided by the 220.2 mile line length, the result is $7,403 per mile. B&V used a value of $5,122 for LME.

4.8.3 Summary and Findings

If the correct entry is input into the cost data, the B&V cost for miscellaneous construction items result in $1,234,153. This results in an increase of $380,248.

Although an entry discrepancy was found in the B&V spreadsheet, the overall methods and estimates used for the construction miscellaneous items are in the range of expected values as compared to RS Means and to similar projects and appear reasonable. Without identifying the exact areas where guard structures are required, the B&V approach appears reasonable with the corrected value.

4.9 Contractor Field Office Facilities and Personnel

The cost components of the contractors field office facilities and personnel are associated with staffing a five-person field office for two 18-month construction periods in two separate locations.

4.9.1 B & V Values and Methodology

B&V assumed the same PEI costs for contractor field office facilities and personnel taken from the Arrowhead–Weston line route and divided the values by the line length of 220.2 miles. B&V estimated two contractor field office facilities with associated personnel for two sections of the King–Weston line, one for King–Eau Claire and one for Eau Claire–Weston. PEI estimated a unit cost of $2,033,454 for each field office facility for a grand total of $4,066,908 for the 220.2 mile Arrowhead–Weston line route.

B&V used a per mile cost of $17,948 for a total of $2,991,848 for the 166.7 mile alternative.

4.9.2 Review Methodology and Comparisons

The unit costs supplied in the Arrowhead–Weston line route were reviewed and appear to be reasonable. The lengths based upon the route were reviewed and these costs were verified in the cost estimate. One discrepancy was found in the entry for the per mile cost. If the $4,066,908 is divided by 220.2 miles, the result is $18,469 per mile. B&V used a value of $17,948.

4.9.3 Summary and Findings

If the correct entry is inputted to the cost data, the B&V cost for contractor field office facilities and personnel would be $3,078,807. This results in an increase of $86,959.

Although an entry discrepancy was found in the B&V spreadsheet, the overall methods and estimates used for contractor field office facilities and personnel are in the range of expected values as compared to RS Means and to similar projects and appear reasonable.

4.10 Construction and Mitigation Plan

The two cost components of the construction and mitigation plan cost are those associated with mitigation of environmental impacts during construction and those associated with monitoring during construction to assure compliance with the construction and mitigation plan.

This estimate for the construction and mitigation plan cost estimate is reasonable.

4.10.1 B & V Values and Methodology

B&V relied on the estimated costs provided by the Applicants for the Arrowhead–Weston line construction and mitigation plan premium of $3,000,000 and divided the total amount by the line length of 220.2 miles to develop a per mile cost of $13,623. The Applicants also supplied B&V with the estimated costs for Arrowhead–Weston line construction and mitigation plan of $3,060,000 and divided the total amount by

the line length of 220.2 miles to develop a per mile cost of $13,896. The costs per mile were then applied to the alternate routes.

4.10.2 Summary and Findings

This estimate for the construction and mitigation plan cost estimate appear to be reasonable.

4.11 Construction Management

4.11.1 B & V Values and Methodology

B&V used a value of $41,938 per mile for construction management. The costs of $41,900 per mile for construction management in the Arrowhead–Weston line route estimate were previously reviewed and found to be reasonable. Based upon the 166.7 mile route the B&V total is $6,991,080.

4.11.2 Review Methodology and Comparisons

As previously reviewed the $41,900 per mile estimate in the Arrowhead–Weston line route cost data appears to be reasonable. The discrepancy between the PEI value of $41,900 per mile and the B&V value of $41,938 per mile is unclear. If the PEI value entry is input into the cost data, the B&V cost construction management would be $6,984,730. This results in a decrease of $6,350.

RS Means estimates construction management as a percent of total construction cost, and ranges from 2.5% for a minimum $5,000,000 project to a maximum of 4%. Comparing the B&V value for construction management to the total construction cost of $208,740,230, results in a value of 3.34%.

4.11.3 Summary and Findings

Detailed analysis of labor and material values in the construction management lump sum amount were not available so the analysis was based upon industry standard values. For the particular circumstances and assumptions of a project of this magnitude, the construction management estimates appear to be in the expected range of 2.5% to 4%. Although there was a minor discrepancy in the per mile values, they appear to be reasonable.

4.12 Clearing Right-of-Way

This section consists of two parts, ROW Clearing & Restoration and ROW Restoration. ROW Clearing and Restoration involved clearing of various types of timber and brush and restoration in upland or wetland areas. It included danger tree removal. ROW Restoration did not involve any clearing, but did have separate units

for restoration on different land types. Miscellaneous units included installation of silt fence, farm gates, and ROW access culverts.

4.12.1 B & V Values and Methodology

The ROW Clearing and Restoration subsection was divided into 150 foot ROW widths and 120 foot widths. The ROW Restoration did not involve any clearing, but was divided into three parts, 120 foot new ROW, 45 foot additional ROW on an existing 69 kV to 115 kV line, and 20 additional feet for existing 138 kV to 230 kV lines.

B&V used an estimate of $17,011 for the 120 foot ROW restoration only and used a ratio increase of 150/120 for the 150 foot ROW.

B&V used a per acre cost from the Arrowhead–Weston Project and converted it to an average per mile cost for ROW clearing and restoration, then multiplied it by the ratio of the percent to clear along the Arrowhead–Weston line route to the alternative route being estimated. Wetland and wooded percent values were obtained from the "Environmental Review of Phase 2 Wisconsin Interface Reinforcement Enhancement Study (WIRES) for the Wisconsin Reliability Assessment Organization (WRAO)" of the WRAO report. This document was included as Appendix C of the May 23, 2003 Cost Estimate Update Report, Revision 1. It is noted that in the text of this report, Table 4.12.-1 – Ratio of Clearing includes values for the percent of woodlands for each alternative, with the Arrowhead–Stone Lake–Weston (Option 3J) at 17.7% woodlands as compared to the King–Eau Claire–Weston (Option 10(1)) at 6.3% woodlands. Therefore, the percent to clear of Option 10(1) to Option 3J was 18.6% or a ratio of 0.47.

4.12.2 Review Methodology and Comparisons

The Appendix C to the May 23, 2003 Cost Estimate Update Report was reviewed to confirm the relative percent of woodlands for each Option. Option 10(1) includes 21% woodlands for the King–Eau Claire segment (65 miles) and 22 % woodlands for the Eau Claire–Weston segment (91 miles). Thus the weighted average amount of woodlands for Option 10(1) is approximately 21.6%. For Option 3J, the Arrowhead–Ladysmith (109 miles) segment includes 58% woodlands and the Ladysmith–Weston (92 miles) segment includes 27% woodlands. Thus the weighted average woodlands for Option 3J is approximately 43.8%. (It is noted that actual lengths of the routes being compared here are based on the line lengths included in Appendix C and actual final route lengths are slightly different.) For the alternative estimate, 50% of the wetlands and all of the wooded lands required clearing.

Therefore, the calculated percent to clear for Option 10(1) is 24.5%. The ratio to clear compared to Option 3J is 46.59%. B&V estimated a ratio to clear of 46.9%.

B&V also assumed that existing 69 kV to 115 kV ROW's were 75 feet wide, 138 kV, 161 kV, and 230 kV ROW's were 100 feet wide. Existing ROW was assumed to be presently cleared and additional clearing was required for the 120 foot wide ROW. Existing 150 foot wide 345 kV ROW's were assumed to be presently cleared.

A 120 foot ROW has approximately 14.5 acres to the mile. B&V used a clearing and restoration value of $41,126 per mile or approximately $2,827 per acre. No detailed breakdown was given, but the estimate was in the expected range of values used on the Arrowhead–Weston line route. B&V estimated the total cost for clearing the ROW to be $5,122,286.

If the total costs of $4,596,050 for clearing and restoration for the Arrowhead–Weston line route are divided by 220.2 miles, the result is a per mile cost of $58,135.

4.12.3 Summary and Findings

Using the revised per mile cost of $58,135 and the revised ratio to clear of 46.6%, results in an estimated total ROW clearing cost of $6,033,853. This results in an increase of $911,567.

For the particular circumstances and assumptions of a project of this magnitude the ROW clearing and restoration estimates appear to be reasonable.

4.13 Land Rights-Easements

This section is separated into two parts, 150 foot and 120 foot ROW Acquisition in fee, and legal acquisition costs.

4.13.1 B & V Values and Methodology

B&V used the same costs for each section that were developed by PEI. The cost estimate breakdowns were as follows. ROW acquisition a 120 foot ROW is $104,000 and $115,500 for a 150 foot ROW based upon $2,500 per acre. ROW acquisition for 8.6 miles is expected for the 150 foot ROW and 158.1 miles for the 120 foot ROW. Legal Assistance is listed at $9,000 per mile for 166.7 miles.

4.13.2 Review Methodology and Comparisons

Review methodology involved comparing the PEI estimates to other similar transmission line projects involving the purchase in fee of ROW along a new route. B&V used a contingency value of 25% for ROW.

4.13.3 Summary and Findings

The necessity for purchasing 8.6 miles of existing 345 kV ROW to build a double circuit 345 kV in the same width of ROW is not stated, but may be due to changing the current ROW agreement for double circuit operation.

Uncertainty of the large number of landowners impacted by this project and varying perceived land values by each landowner may be the cause for higher than expected values. The values for land rights for a project of this magnitude, over the varying land types for the alternative route appear to be reasonable.

4.14 Removal

Removal refers to the demolition and removal associated with 345 kV and lower voltage transmission lines that utilize wood construction.

4.14.1 B & V Values and Methodology

B&V used the per mile PEI estimates, which included costs to remove one circuit mile of 954 kcmil conductor, one circuit mile of shield wire, and depending on the voltage level, a certain number of wood H-frame type structures with associated hardware.

As stated in the estimate review of the Arrowhead–Weston line route, there appears to be an error in the unit descriptions. B&V applied the 69-230 kV removal cost of $25,666 to 64.5 miles of line and the 345 kV removal cost of $43,680 to 8.6 miles of line. The removal cost totaled $2,031,075.

4.14.2 Review Methodology and Comparisons

Review methodology involved comparing the B&V/PEI estimates to actual bid values for two different 115 kV H-frame transmission lines in Alaska. Construction and removal of one line was in an environmentally sensitive area along wetlands and mountainous terrain in summer conditions at an approximate removal cost of $40,521 per mile. The second 115 kV line was also in an environmentally sensitive area along wetlands over flat terrain in winter (frozen ground) conditions at an approximate removal cost of $30,423 per mile. These removal costs included conductor, poles, cross-arms, x-braces, and guy wire, but no shield wire.

4.14.3 Summary and Findings

The B&V estimates for removal appear reasonable and within the expected range compared to similar transmission projects.

4.15 Salvage

Salvageable items include insulators, hardware, guys, and conductor/wire resulting from the demolition of transmission lines from 69 thru 345 kV and result in a credit to the project.

4.15.1 B & V Values and Methodology

B&V used the estimated Arrowhead–Weston line route salvage value of $280 per mile for 69-230 kV lines and $8,700 per mile for 345 kV lines. A detailed review was not available. The total credit estimated for the alternative was a credit of $92,880 for 64.5 miles of 69-230 kV lines and 8.6 miles of 345 kV lines.

4.15.2 Review Methodology and Comparisons

The condition of removed material and equipment and its potential for re-use are not possible until the lines are removed and a condition assessment is performed.

4.15.3 Summary and Findings

The only material normally salvaged is the poles and then, only if they have been recently installed (within the last year). The cross-arms, x-braces, and guy wire are normally not reused. Conductor and shield wire is never reused for another line due to the unknown loads that may have been imposed upon it. If an ACSR (aluminum conductor steel reinforced) conductor is sold for scrap, the steel is generally separated from the aluminum which is labor intensive and decreases the value.

At times, if the removed poles are given to landowner that is impacted by the line construction, the cost benefit may be in the form of customer satisfaction and part of the easement negotiations.

Salvage represents a minor cost element and changes to the assumptions for salvage will have a very minor impact on construction costs.

4.16 Local Engineering

Local engineering covers three main areas, Applicants Cost, Public Information and Community Outreach, and Costs Associated with Oversight and Access.

4.16.1 B & V Values and Methodology

The values supplied in the PEI report came from the Applicants and are separated into two parts; Cost Expended to June 6, 2002, and Cost to Complete for Applicants. B&V used a per mile cost of $45,663 for a total Applicants cost of $7,612,077. The local engineering section totaled $11,362,077.

4.16.2 Review Methodology and Comparisons

The Local Engineering section totaled $16,571,841 for the Arrowhead–Weston line route. The $3,000,000 estimate for ATC's Public Information and Outreach and the $750,000 estimate for Costs Associated with Suits and Access should be subtracted from the overall Local Engineering costs and results in a value of $12,821,841. If the $2,175,910 cost to date for local engineering in the PEI estimate is subtracted, the result is $10,645,931. The costs to date are incorporated as a separate line item in the overall alternative estimates. Dividing the $10,645,931 by the 220.2 miles Arrowhead–Weston line length, results in a per mile cost of $48,347.

4.16.3 Summary and Findings

A detailed analysis of all values in the local engineering amount was not available, so the analysis was compared to typical industry values. The $3,000,000 estimate for

ATC's Public Information and Outreach and the $750,000 estimate for Costs Associated with Suits and Access were taken as lump sum costs from the Arrowhead–Weston project.

If the corrected entry is inputted to the cost data, the B&V estimate for the Applicants cost would be $8,059,386. This results in an increase of $447,308.

Using the recalculated values the total cost of local engineering would be $11,809,386. If the local engineering is taken as a percentage of the total project cost of $386,707,671, a value of 3.05% is obtained. A typical value for local engineering (also called Owners Overhead Expense) in the transmission industry is 3% of the total project cost.

Although an entry discrepancy was found in the B&V spreadsheet, the overall methods and assumptions for a project of this magnitude the local engineering cost appears to be reasonable.

4.17 Foreign Engineering

The values supplied for Foreign Engineering were supplied by PEI who developed the total construction cost estimate for the project. It covers four main areas: Engineering Design & Project Management, Ground & Aerial Survey, Soils Investigation, and Engineering Studies.

4.17.1 B & V Values and Methodology

A detailed analysis of the costs was not available, but B&V used values based upon the Arrowhead–Weston line route and developed a per mile cost to apply to the alternative route. The PEI engineering design and project management subsection of the Foreign Engineering section listed a value $6,782,160 or $30,800 per mile. Ground and Aerial Survey per mile units were $35,700 and $1,900, respectively. The soils investigation lump sum cost of $748,680 in the PEI estimate divided by the 220.2 mile Arrowhead–Weston line route resulted in a per mile cost of $3,400 and the engineering studies amounted to $1,300 per mile.

The foreign engineering values listed above total $12,185,770 for the section.

4.17.2 Review Methodology and Comparisons

Cost comparisons were made previously for the Arrowhead–Weston line route for three of the main areas. Engineering Design & Project Management, Ground & Aerial Survey, and Soils Investigation and were found to be reasonable. RS Means lists percentages in the range of 2.5% to 10.1% for Engineering Design.

4.17.3 Summary and Findings

A detailed analysis of all the foreign engineering values was not available, so the analyses were based upon typical industry values. If the foreign engineering section is

compared to the total Construction Cost, the overall percentage is approximately 5.8% and is within the expected 2.5% to 10.1% range and appears to be reasonable.

4.18 Project Licensing Costs

4.18.1 B & V Values and Methodology

Based on B&V's review of costs to date for the Arrowhead–Weston alternative, licensing costs for other alternative routes were assumed to be equal to the Arrowhead–Weston estimate. Based on the recorded costs of the Applicants, licensing costs have been incurred in the amounts of approximately $9,100,000 for Wisconsin and approximately $2,500,000 for Minnesota. Also, in Minnesota regulatory requirements have changed since initial approval of the Arrowhead–Weston project. It is now estimated that the Minnesota licensing process will cost an additional $2,500,000. For this reason B&V decided to increase the licensing cost for Minnesota to $5,000,000. Therefore, B&V's total licensing cost estimate for the King–Eau Claire–Weston alternative was $14,100,000.

4.18.2 Review Methodology and Comparisons

A review of the licensing cost for the Arrowhead–Weston Project indicates that a higher cost may ultimately be incurred than $14,000,000. Discussions with ATC indicate that the total cost for Arrowhead–Weston line route could be in the range of $20,000,000 to $30,000,000 or approximately $90,000 to $136,000 per mile.

Using these per mile costs the King–Eau Claire–Weston route (Option 10(2)) which is 168.9 miles in length, the licensing costs could range from approximately $15,000,000 to $23,000,000. Key issues that affect the estimated licensing cost are the amount of wetlands involved, and the stream crossings. Both the Arrowhead–Weston route and the King–Eau Claire–Weston route involve scenic river crossings. The King–Eau Claire–Weston route has less wetland involved as compared to the Arrowhead–Weston route (6% versus 18%). This difference in wetlands would be expected to reduce the licensing costs. On the other hand the amount of agricultural land that must be crossed is higher for the King–Eau Claire–Weston route as compared to the Arrowhead–Weston route. This could easily off set the reduced costs associated with wetlands. Therefore, it appears reasonable to assume that licensing costs for the King–Eau Claire–Weston (Option 10(2)) will be approximately equal to the licensing costs for the Arrowhead–Weston route.

4.18.3 Summary and Findings

B&V assumed that the licensing costs for the King–Eau Claire–Weston alternative route would be equal to the licensing costs for the Arrowhead–Weston route estimated at $14,100,000. Recent discussions with ATC indicate that this amount may be low for the Arrowhead–Weston route. To extent that this value increases, it is reasonable

to assume that a similar increase would be applicable to the King–Eau Claire–Weston alternative.

4.19 Substation Costs

4.19.1 B & V Values and Methodology

The Applicants provided cost estimates for the Arrowhead and Weston Substations. Preliminary cost estimates included in the WRAO report were found to increase by a factor of three when more detailed planning and engineering was completed. B&V escalated the WRAO substation costs by a factor of three, with the exception of the detailed estimate of $25,328,589 for the Weston Substation. The King and Eau Claire Substations were increased from $2,198,000 and $2,301,000 to $6,594,000 and $6,903,000, respectively.

4.19.2 Summary and Findings

Detailed cost estimates were not available for the King and Eau Claire Substations, but estimates for the Weston Substation were previously found to be reasonable based on a comparison of cost to substations of similar size and capacity using recent material and construction cost. A detailed layout and equipment list were not provided for the King and Eau Claire Substations, therefore, there is no basis to find the costs unreasonable.

4.20 AFUDC

4.20.1 B & V Values and Methodology

B&V used the Applicant's AFUDC calculation procedure which consisted of obtaining the actual AFUDC worksheet and verifying the methods used to calculate the AFUDC.

The AFUDC appears to have been estimated in accordance with FERC guidelines.

The Applicant's AFUDC estimated for Option One assumes a Weighted Average Cost of Capital (WACC) of 9.6%. Given the FERC allowed return on equity of 12.2% and the 50% debt-equity target utilized by the applicant in the Arrowhead–Weston option, the implied cost of debt for a WACC of 9.6% is 7% annually. This is higher than the cost of debt that appears to have been used in the Arrowhead–Weston option for estimating AFUDC. In the Arrowhead–Weston option, the Applicants utilized an embedded cost of debt of approximately 3-3.5%.

4.20.2 Summary and Findings

Project analysis typically requires that assumptions for cost of equity and debt, as well as debt-equity ratio targets be identical for each project unless the project itself results

in a changed financial environment. Utilizing the 3-3.5% annual debt cost that appears to have been used in the Arrowhead to Weston option results in AFUDC of approximately $42,100,000 to $43,500,000, compared to the applicants' estimation of approximately $51,500,000.

4.21 Environmental Impact Fee

As discussed in Section 2.21 the Environmental Impact Fee is a 5 % surcharge on the as-built construction costs, including licensing costs and AFUDC. This cost factor should be applied to the estimated costs for the King–Eau Claire–Weston alternative route.

4.22 Farm Disease Mitigation

As discussed in Section 2, a significant issue that has recently been identified during the evaluation of the Arrowhead–Weston Project is the issue of farm disease mitigation. This issue would be expected to have a higher level of concern for the King–Eau Claire–Weston route as compared to the Arrowhead–Weston route due to higher percentages of agricultural land that will be crossed by the ROW.

4.22.1 B & V Values and Methodology

B&V used the estimated values from PEI and the Applicants of $15,000,000 for farm disease mitigation based on investigations and reviews and adjusted it based upon percentage of agricultural land. Agricultural values were obtained from the "Environmental Review of Phase 2 Wisconsin Interface Reinforcement Enhancement Study (WIRES) for the Wisconsin Reliability Assessment Organization (WRAO)" of the WRAO report. B&V listed a value of $25,648,747 for farm disease mitigation and the ratio used appears to be approximately 171%, but was not detailed.

4.22.2 Review Methodology and Comparisons

Appendix C of the May 23, 2003 Cost Audit Report – Revision 1 was used to compare the lengths of the alternate routes and the percentages of agricultural land associated with each alternative. The Ladysmith–Weston segment of Option 3(J) (Arrowhead–Weston) is estimated to have approximately 22.3% agricultural land in the ROW with a line length of 92 miles. This is compared to a 47.7% weighted average of agricultural land for Option 10(1) with a line length of 156 miles (it is noted this is slightly different than the final alternative route). Using the Ladysmith–Weston segment agricultural land length of 40.48 miles (92 miles x 0.44 = 40.48 miles) and applying the estimated farm disease mitigation cost of $15,000,000 results in a cost per mile of $370,553 per mile. Using this value the estimated cost for Option 10(1) would be $27,573,590 (156 miles x 0.48 x $370,553 = $27,573,590). This compares reasonable well with the B&V value stated above. The difference is likely the result of slightly different assumptions.

4.22.3 Summary and Findings

Based on the assumed value of $15,000,000 for the farm disease mitigation for the Arrowhead–Weston line route and comparison of the amount of agricultural land in the ROW for the King–Eau Claire–Weston line route, as compared to Arrowhead–Weston route, the estimated farm disease mitigation costs is estimated at $27,573,590 for the King–Eau Claire–Weston route. This reflects an increase of approximately $1,924,843 as compared to the B&V estimate.

4.23 Outage Management

Outage management costs were supplied by the Applicants to account for items associated with temporarily reinforcing the existing transmission system to assure system reliability during periods when the existing lines are reconstructed. The value may contain many different costs, such as additional costs of generation from different sources to increase reliability when a major line is disconnected during a certain period. Joint construction of over 100 miles of existing line has modified the construction schedule and put increased constraints on outage management and electrical reinforcement Review Methodology and Comparisons

B&V used the same value, $4,180,773 given in the PEI estimate for outage management listed as the Stone Lake Substation. The value is a direct result of the Commission's line routing protocol of corridor sharing with existing transmission lines. B&V assumed that the King–Weston route would be impacted by the same outage management constraints as the Arrowhead–Weston route.

4.23.1 Summary and Findings

Data to substantiate the listed value was not available, and outage costs of a line can vary significantly around the U.S. and the need for a temporary substation for this alternative is unknown. The additional cost of generation, transmission wheeling charges, switching, reconfiguring relay and protection schemes and the impacts upon the electrical consumer may be considerable.

For additional comparison, a similar transmission line project had actual values for outage management of $30,000 per day. For the particular circumstances and assumptions of a project of this magnitude the outage management estimate appears to be reasonable.

Section 5
KING–WESTON CONTINGENCY VALUES

5.1 B & V Values and Methodology

No single contingency value as a line item was assumed for the overall construction cost estimate. The cost estimates were taken as percentage ratios or estimated values of the costs from the Arrowhead–Weston route. Some of the line items, listed in the Arrowhead–Weston cost estimate listed contingency of 25%.

5.2 Review Methodology and Comparisons

Due to single line item values being listed in the overall construction cost estimate analysis of contingency values used is difficult. Projects of this size and scope normally have a contingency value listed as a percent of construction.

RS Means estimates contingency values in four categories as follows:

- Conceptual Stage 20%
- Schematic Stage 15%
- Preliminary Working Drawing Stage 10%
- Final Working Drawing Stage 3%

5.3 Summary and Findings

For comparison purposes, this project is considered to be in the Pre-Conceptual Stage since the route location is still in question.

While a value was not specifically given, an expected reasonable value for contingency at this preliminary stage would be 25%.

Section 6
SUMMARY AND FINDINGS

6.1 Arrowhead–Weston Transmission Line

The following table details the total costs for transmission line construction evaluated for in the report. The totals evaluated without contingency result in a decrease of less than 3%. The high level of detail involved along with the numerous revisions in the cost estimate preparation for the Arrowhead-Weston project should not result in the final costs to vary significantly. Projects of this size and scope normally have a contingency value listed as a percent of construction and one was not listed for the unit items or in the overall construction cost estimate. A 15% contingency should be planned for the transmission line and substation construction due to it being in the schematic stage of design.

For a project of this size and scope and the assumptions that were made, the Power Engineers, Inc. cost estimate and the Black & Veatch cost estimate review for the Arrowhead-Weston line route appears reasonable. This conclusion is based upon previous project experience and on the review of the detailed components supplied in the estimates.

Table 6-1
Arrowhead-Weston Transmission Line Construction Cost Summary Comparison

PROJECT ELEMENT DESCRIPTIONS	PEI VALUES	R. W. BECK VALUES
TRANSMISSION CONSTRUCTION		
Structures & Foundations	$120,718,403	$119,518,403
Foundation Adders	$6,655,603	$6,655,603
Counterpoise for Added Grounding	$953,379	$953,379
Wire	$30,825,867	$30,825,867
Wetlands Accessibility Adder	$8,819,326	$8,819,326
Mobilization and Demobilization	$1,140,440	$1,140,440
Environmental Devices	$1,890,577	$1,890,577
Miscellaneous Construction Items	$1,630,237	$1,630,237
Contractor Field Office Facilities and Personnel	$4,066,908	$4,066,908
Construction & Mitigation Plan – Premium & Monitoring	$6,060,000	$6,060,000
Construction Management	$9,226,380	$9,226,380
TOTAL TRANSMISSION CONSTRUCTION	**$191,987,120**	**$191,987,120**
COMMUNICATION - OPGW 12-fiber	**$4,312,000**	**$4,312,000**
CLEARING RIGHT-OF-WAY	**$7,221,722**	**$8,546,723**
LAND RIGHTS - EASEMENTS		
ROW Acquisition & Legal Assistance	$23,942,500	$16,087,908
Railroad & Pipeline Interference Studies	$1,225,000	$1,225,000
Namekagon EIS	$500,000	$500,000
TOTAL LAND RIGHTS - EASEMENTS	**$25,667,500**	**$17,812,908**
REMOVAL	**$2,702,778**	**$2,702,778**
SALVAGE	**$(58,900)**	**$0**
LOCAL ENGINEERING	**$16,571,841**	**$16,571,841**
FOREIGN ENGINEERING	**$16,096,620**	**$16,096,620**
FARM DISEASE MITIGATION	**$15,000,000**	**$15,000,000**
TEMPORARY LINE CONSTRUCTION	**$2,000,000**	**$2,000,000**
SUBTOTAL TRANSMISSION LINE CONSTRUCTION	**$281,500,681**	**$273,427,111**
CONTINGENCY – 15%	**$0**[1]	**$41,014,066**
TOTAL TRANSMISSION LINE CONSTRUCTION	**$281,500,681**	**$314,441,178**

[1] No contingency was specified except in the values for Land Rights and Substations.

Below is the total project cost comparison without contingency.

Table 6-2
Arrowhead-Weston Cost Summary Comparison Without Contingency

Description	PEI Cost Estimate	R. W. Beck Values
Transmission Line	$281,500,681	$273,427,111[1]
Substations	$56,804,501	$56,804,501
Subtotal Transmission Line & Substations	$338,305,184	$330,231,612
Licensing	$8,239,000	$8,239,000
Environmental Impact Fee	$17,360,966	$17,020,352
AFUDC	$56,402,332[2]	$55,250,718[3]
Totals	**$420,307,482**	**$410,741,682**

6.2 King–Weston Transmission Line Alternative

The following table details the total costs for transmission line construction evaluated for in the report. The totals evaluated without contingency result in an increase of less than 3%. Projects of this size and scope normally have a contingency value listed as a percent of construction and one was not listed for the unit items or in the overall construction cost estimate. A 25% contingency should be planned for the transmission line and substation construction project due to it being in the pre-conceptual stage of design.

For a project of this size and scope and the assumptions that were made, the Black and Veatch cost estimate for the alternative King–Weston line route appears reasonable.

[1] In order to compare values on a relative basis, contingency has been excluded. However, given the uncertainty with respect to licensing costs, farm disease mitigation and land rights-easements consideration should be given to include a contingency in the total project cost.
[2] $57,912,394 After correcting for apparent interest rate error (15.9% - Transmission line subtotal plus environmental impact fee.
[3] 15.9% of transmission line subtotal plus environmental impact fee.

Table 6-3
King-Weston Transmission Line Construction Cost Summary Comparison

PROJECT ELEMENT DESCRIPTIONS	B&V VALUES	R. W. BECK VALUES
TRANSMISSION CONSTRUCTION		
Structures & Foundations	$74,431,560	$77,500,020
Foundation Adders	$5,002,090	$5,031,172
Counterpoise for Added Grounding	$721,811	$721,811
Wire	$23,997,911	$23,633,874
Wetlands Accessibility Adder	$3,641,247	$2,231,311
Mobilization and Demobilization	$1,140,440	$863,360
Environmental Devices	$1,382,825	$1,431,240
Miscellaneous Construction Items	$853,906	$1,234,153
Contractor Field Office Facilities and Personnel	$2,991,848	$3,078,807
Construction & Mitigation Plan – Premium & Monitoring	$4,591,827	$4,587,657
Construction Management	$6,991,080	$6,984,730
TOTAL TRANSMISSION CONSTRUCTION	**$125,746,545**	**$127,298,135**
COMMUNICATION - OPGW 12-fiber	**$1,833,700**	**$3,267,320**
CLEARING RIGHT-OF-WAY	**$5,122,286**	**$6,033,853**
LAND RIGHTS - EASEMENTS	**$18,936,000**	**$18,936,000**
REMOVAL	**$2,031,075**	**$2,031,075**
SALVAGE	**$(92,880)**	**$(92,880)**
LOCAL ENGINEERING	**$11,362,077**	**$11,362,077**
FOREIGN ENGINEERING	**$12,185,770**	**$12,185,770**
MISCELLANEOUS TRANSMISSION LINE		
Farm Disease Mitigation	$25,648,747	$27,573,590
Outage Management	$4,180,773	$4,180,773
Temporary Line Construction	$2,000,000	$2,000,000
TOTAL MISCELLANEOUS TRANSMISSION LINE	**$31,829,520**	**$33,754,363**
SUBTOTAL TRANSMISSION LINE CONSTRUCTION	**$208,954,093**	**$214,775,713**
CONTINGENCY – 25%	**$0**[1]	**$53,693,928**
TOTAL TRANSMISSION LINE CONSTRUCTION	**$208,954,093**	**$268,469,641**

[1] No contingency was specified except in the values for Land Rights and Substations.

Below is the total project cost comparison without contingency. The transmission line and substations have been inflated over 5 years at 3% per year due to the additional time required for permitting, licensing, environmental impact statements, public review and comment, and Commission review. The approximate inflation value for the 5 year extension for the transmission line and substations totaled 15.93%. If the $208,954,093 for the total line construction is inflated at an approximate rate of 3% over the estimated period of 5 years the result is $241,987,137. The R.W. Beck value of $214,775,713 for total line construction without contingency will inflate to $248,983,916.

The AFUDC calculations were based upon the Applicants spreadsheets which made assumptions for cash flow and the extended project schedule. B&V calculated the AFUDC differently than the Applicants which resulted in a difference. This evaluation involved using the same methods as supplied to PEI by the Applicants for the Arrowhead–Weston line.

Table 6-4
King–Weston Total Project Cost Summary Comparison Without Contingency

Description	B&V Cost Estimate	R. W. BECK VALUES
Transmission Line	$241,987,137	$248,983,916[1]
Substations	$45,009,975	$45,009,975
Subtotal Transmission Line & Substations	$286,997,112	$293,993,891
Costs Expended to Date	$17,700,000	$17,700,000
Licensing	$14,100,000	$14,100,000
Environmental Impact Fee	$16,397,720	$16,331,288
AFUDC	$51,512,838[2]	$42,267,510[3,4]
Total Project Cost	**$386,707,670**	**$384,392,689**

The project estimates were developed from many sources and various assumptions that may vary the final cost after all the project parameters are established. The high level of detail involved along with the numerous revisions in the cost estimate preparation for the Arrowhead–Weston project may result in the final updated costs for the King–Weston project to vary significantly.

[1] In order to compare values on a relative basis, contingency has been excluded. However, given the uncertainty with respect to licensing costs, farm disease mitigation and land rights-easements consideration should be given to include a contingency in the total project cost.
[2] $43,544,835 at a debt cost of 3.5% or 14.35% of transmission line subtotal plus environmental impact fee.
[3] 16.98% of transmission line subtotal plus environmental impact fee.
[4] $44,094,423 after adjusting AFUDC to debt costs of 3.5% (16.98% - Transmission line subtotal plus environmental impact fee.

The alternative estimate was based on existing transmission lines, within share rights-of-way, being de-energized during the construction period. No additional costs are included for river crossings or underground crossings at the river locations. Additional costs of overhead river crossings could be several million dollars and the underground crossing at the Interstate 94 bridge over the St. Croix River may be in the 10 million dollar range, as a minimum.

Appendix A

DOCUMENTS REVIEWED

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DOCUMENTS REVIEWED

List of Documents Reviewed

Description of Document	R. W. Beck Document #
Report of the Wisconsin Reliability Assessment Organization (WRAO) on Transmission System Reinforcement in Wisconsin - WIREs Phase II Study Report, Env. Review, Intercon. Capacity Req., Geo. Diversity, Stakeholder Comments	900-01
A-W Electric Transmission Line Project - Final Environmental Impact Statement - Volume 1	900-02
A-W Electric Transmission Line Project - Final Environmental Impact Statement - Volume 2	900-03
Public Service Commission of Wisconsin - Final Decision of CPCN Filing for Arrowhead-Weston Project	900-04
Notice Of Cost Increase And Petition To Amend The Final Order With A Revised Cost Estimate	900-05
ATC A-W 345 kV T-Line Cost Estimate Audit Report by Black & Veatch	900-06
Wisconsin Western Interface Alternatives - Cost Estimate Update Report	900-07
Construction and Mitigation Plan "PART A"	900-08
Arrowhead Weston Transmission VHS Tape 1	900-09
Arrowhead Weston Transmission VHS Tape 2	900-10
Arrowhead Weston Transmission VHS Tape 3	900-11
Arrowhead Weston Transmission VHS Tape 4	900-12
Official Filing Service List - 41 Total - Updated	1000-01
ATC A-W 345 kV T-Line - **Cost Estimate Audit Report - Revision 1** by Black & Veatch - May 23, 2003	1000-02
Wisconsin Western Interface Alternatives - Cost Estimate Update Report, **Revision 1** - May 23, 2003	1000-03
An Update to the Cost Estimates that were submitted under Tab A of Nov. 26, 2002 - Notice of Cost Increase And Petition To Amend The Final Order With A Revised Cost Estimate	1000-04
An Update to the Range of Cost Contingency Estimates that were submitted under Tab B of Nov. 26, 2002 - Notice of Cost Increase And Petition To Amend The Final Order With A Revised Cost Estimate	1000-05
A_W 345 kV T-Line Project - **Revised** Engineers Cost Estimate by Power Engineers dated May 6, 2003	1000-06
Underbuild Analysis	1000-07
Line Segment Data MP Rte Arrowhead Hwy 27	1000-08

A-W 345 kV TL -Power Engineers Cost Estimate Aug. 27, 2002	1000-09
A-W 345 kV TL -Power Engineers Cost Estimate Oct. 22, 2002	1000-10
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Conceptual Design Status Update - Weston (Substation) 345kV Project Station Facilities - Updated May 6, 2002 by ECI Consultants	1000-15
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Opinion of Probable Cost for Weston 345 New South Switchyard by Dan Donovan - ECI	1000-24A
Arrowhead - Weston Project Cost Estimate Summary (RCN), Licensing Costs, Weston Substation -6 pages total	1000-25
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